

NUCLEAR SCIENCE ABSTRACTS

Vol. 7, No. 3, February 15, 1953

TABLE OF CONTENTS

Category	Abstract	Page	Category	Abstract	Page
REPORTS REFERENCE LIST		ii	MINERALOGY, METALLURGY, AND CERAMICS		
GENERAL	712	87	Geology and Mineralogy	815	
Research programs	712		Metals and Metallurgy	821	
BIOLOGY AND MEDICINE	713	87	PHYSICS	844	103
Radiation Effects	715		Cosmic Radiation	854	
Radiation Hazards and Protection	734		Crystallography and Crystal Structure	862	
Radiation Sickness	743		Electrical Discharge	863	
Radiography	745		Electrons	868	
Radiotherapy	747		Gases	878	
Toxicology Studies	758		Instruments	877	
Tracer Applications	761		Isotopes	889	
CHEMISTRY	773	94	Mathematics	892	
Analytical Procedures	778		Measuring Instruments and Techniques	895	
Crystallography and Crystal Structure	782		Mesons	919	
Fluorine and Fluorine Compounds	784		Neutrons	926	
Molecular Structure	789		Nuclear Physics	929	
Radiation Effects	791		Nuclear Properties	936	
Rare Earths and Rare-earth Compounds	792		Nuclear Reactors	959	
Separation Procedures	793		Nuclear Transformation	962	
Syntheses	794		Particle Accelerators	973	
Tracer Applications	799		Radiation Absorption and Scattering	976	
Transuranic Elements and Compounds	800		Radiation Effects	994	
Uranium and Uranium Compounds	801		Radioactivity	998	
ENGINEERING	802	97	Rare Earths and Rare-earth Compounds	1024	
Heat Transfer and Fluid Flow	804		Shielding	1025	
Materials Testing	811		Theoretical Physics	1026	
Pumps	812		Tritium and Tritium Compounds	1032	
MINERALOGY, METALLURGY, AND CERAMICS	813	99	AUTHOR INDEX	INDEX-1	
Ceramics and Refractories	813		NUMERICAL INDEX OF REPORTS	INDEX-6	
			NEW NUCLEAR DATA	SUPPLEMENT-1	

REPORTS REFERENCE LIST

Vol. 7, No. 3

The abstract number for each report is listed at the upper right of the entry. If the number bears an asterisk, the report is title listed only and no abstract is included.

U. S. ATOMIC ENERGY COMMISSION DECLASSIFIED REPORTS

- AECD-3471 926
Oak Ridge National Lab.
THEORY OF NEUTRON CHAIN REACTIONS: EXTRACTS FROM VOLUME I, DIFFUSION AND SLOWING DOWN OF NEUTRONS: CHAPTER I. ELEMENTARY THEORY OF NEUTRON DIFFUSION. CHAPTER II. SECOND ORDER DIFFUSION THEORY. CHAPTER III. SLOWING DOWN OF NEUTRONS, by Alvin M. Weinberg and L. C. Noderer. May 15, 1951. Decl. June 19, 1952. 202p. (AECD-3471; CF-51-5-98)
- AECD-3472 813
North American Aviation, Inc.
THE CORROSION OF REFRACTORY MATERIALS IN SODIUM, by R. L. Loftness, W. C. Ruebsamen, and T. A. Coultas. Issued Nov. 20, 1951. Decl. with deletions Dec. 1, 1952. 41p. (AECD-3472; NAA-SR-126)
- AECD-3475 784
Carbide and Carbon Chemicals Co. (K-25)
NON-IDEALITY OF URANIUM HEXAFLUORIDE VAPOR: PART I, by R. D. Ackley and PART II, by D. W. Magnuson. Issued Dec. 28, 1951. Decl. Dec. 2, 1952. 9p. (AECD-3475; K-840)
- AECD-3476 821*
Oak Ridge National Lab.
BORAL: A NEW THERMAL NEUTRON SHIELD, SUPPLEMENT I, by A. S. Kitzes and W. Q. Hullings. Issued July 3, 1951. Decl. Dec. 4, 1952. 18p. (AECD-3476; ORNL-981)
- AECD-3477 959
Oak Ridge National Lab., Y-12 Area
REACTOR THEORY TERMS, by C. B. Mills and George B. Arfken. July 16, 1952. Decl. with deletions Dec. 4, 1952. 128p. (AECD-3477; Y-F10-106)
- AECD-3479 794
Los Alamos Scientific Lab.
CONDENSATIONS OF PRIMARY ALIPHATIC NITRAMINES WITH FORMALDEHYDE, by Leon Goodman. [nd] Decl. with deletions Dec. 22, 1952. 8p. (AECD-3479; LADC-1279)
- AECD-3483 801
Carbide and Carbon Chemicals Co. (K-25)
LIQUID-VAPOR EQUILIBRIUM IN THE SYSTEM URANIUM HEXAFLUORIDE-HYDROGEN FLUORIDE, by R. L. Jarry, F. D. Rosen, C. F. Hale, and W. Davis, Jr. Issued Mar. 10, 1952. Decl. with deletions Dec. 29, 1952. 40p. (AECD-3483; K-872)

U. S. ATOMIC ENERGY COMMISSION UNCLASSIFIED REPORTS

- AECU-2294 715
Cancer Research Inst., New England Deaconess Hospital, Boston
THE ULTRAVIOLET MICROSCOPY OF THE LIVING CELL'S RESPONSE TO LETHAL X-RADIATION, by P. O'B. Montgomery and Shields Warren. [nd] 9p (AECU-2294)
- AECU-2295 716
Johns Hopkins Univ.
MODIFICATION, THROUGH THE USE OF SUPPLEMENTARY ENVIRONMENTAL FACTORS, OF THE FREQUENCY AND TYPES OF GENE AND CHROMOSOME CHANGES INDUCED BY X-RAYS, ULTRAVIOLET LIGHT, AND NITROGEN MUSTARD, by W. D. McElroy and C. P. Swanson. Issued Nov. 15, 1951. 9p. (AECU-2295)
- AECU-2305 877
[Argonne National Lab.]
IMPROVEMENT OF THE RELIABILITY OF THE WILLIAMS MEMORY BY DOUBLE INSPECTION, by Robert W. Schumann. Sept. 3, 1952. 10p. (AECU-2305; UAC-662)
- AECU-2306 892
[Argonne National Lab.]
THE SELECTION OF TUBES FOR THE WILLIAMS MEMORY, by J. C. Chu and R. J. Klein. Sept. 3, 1952. 11p. (AECU-2306; UAC-661)
- AECU-2323 778
Sloan-Kettering Inst. for Cancer Research
STUDIES ON THE STRUCTURE OF NUCLEIC ACIDS. VI. THE KINETICS OF DESOXYRIBONUCLEASE ACTION, by Liebe F. Cavalieri and Barbara Hatch. [nd] 17p. (AECU-2323)
- AECU-2324 814
Knolls Atomic Power Lab.
CERAMIC WHEEL SPHERE GRINDER, by Peter Senio and Charles W. Tucker, Jr. [nd] 3p. (AECU-2324)
- AECU-2326 976
Los Alamos Scientific Lab.
ELASTIC SCATTERING OF PROTONS AND NEUTRONS BY DEUTERONS, by R. S. Christian and J. L. Gammel. [nd] 64p. (AECU-2326; LADC-1311)
- AECU-2328 734
Oak Ridge National Lab.
MAXIMUM PERMISSIBLE NEUTRON FLUX FOR FAST AND THERMAL NEUTRONS, by W. S. Snyder and J. Neufeld. [nd] 1p. (AECU-2328)

- AECU-2330** 822
Institute of Engineering Research, Univ. of Calif., Berkeley
TECHNICAL PROGRESS REPORT [ON] CREEP OF ALLOYS RESEARCH [FOR] JULY 1 TO DECEMBER 1, 1952, by E. R. Parker and T. H. Hazlett. Dec. 1, 1952. 5p. (AECU-2330)
- BMI-786** 811
Battelle Memorial Inst.
THE PERFORMANCE OF WATER-LUBRICATED SLEEVE BEARINGS, by R. W. Dayton, C. M. Allen, and H. A. Van Dyke. Dec. 2, 1952. 34p. (BMI-786)
- BNL-1259** 713
Brookhaven National Lab.
FLOW BIREFRINGENCE STUDY OF THE FIBRINOGEN-FIBRIN CONVERSION, by J. K. Backus, M. Laskowski, Jr., H. A. Scheraga, and L. F. Nims. Cornell Univ. and Brookhaven National Lab. [nd] 20p. (BNL-1259)
- BNL-1278** 747
Brookhaven National Lab.
DOSIMETRIC CONSIDERATIONS IN DETERMINING HEMATOPOIETIC DAMAGE FROM RADIOACTIVE IODINE, by J. E. Rall, Charles G. Foster, Jacob Robbins, R. Lazerson, Lee E. Farr, and Rulon W. Rawson. Brookhaven National Lab. and Sloan-Kettering Inst. for Cancer Research and Memorial Center, New York. [nd] 21p. (BNL-1278)
- BNL-1285** 717
Brookhaven National Lab.
VARIATIONS IN THE FLORAL MORPHOLOGY OF NORMAL AND IRRADIATED PLANTS OF TRADESCANTIA PALUDOSA, by James E. Gunckel, Ielene B. Morrow, Arnold H. Sparrow, and Eric Christensen. [nd] 21p. (BNL-1285)
- BNL-1294** 998
Brookhaven National Lab.
THE PROBABLE EXISTENCE OF AN E3 + M4 MIXTURE IN AN ISOMERIC TRANSITION, by R. D. Hill and J. W. Mihelich. [nd] 4p. (BNL-1294)
- BNL-1299** 718
Brookhaven National Lab.
THE EFFECT OF IONIZING RADIATIONS UPON THE RESPIRATION AND OXIDASES OF THE POTATO TUBER, by Alfred S. Sussman, Michigan Univ. and Brookhaven National Lab. [nd] 25p. (BNL-1299)
- BNL-1300** 999
Brookhaven National Lab.
SHORT-LIVED CERIUM ISOTOPES FROM URANIUM FISSION, by A. A. Caretto, Jr. and S. Katcoff. [nd] 4p. (BNL-1300)
- CF-52-11-1** 735
Oak Ridge National Lab.
SAMPLING METHODS AND REQUIREMENTS FOR ESTIMATING AIRBORNE RADIOPARTICULATE HAZARDS, by Thomas J. Burnett. Nov. 21, 1952. 57p. (CF-52-11-1)
- ISC-270** 789
Institute for Atomic Research, Iowa State Coll.
ELECTRON DEFICIENT COMPOUNDS. VII. THE STRUCTURE OF THE TRIMETHYLALUMINUM DIMER, by Paul H. Lewis and R. E. Rundle. Oct. 1952. 30p. (ISC-270)
- ISC-276** 1000
Ames Lab.
RADIATIONS OF CERTAIN SYNCHROTRON-INDUCED RADIOACTIVITIES, by Streatfield H. Cox, Jr. and L. Jackson Laslett. June 1952. 28p. (ISC-276)
- K-944** 804
Carbide and Carbon Chemicals Co. (K-25)
LAMINAR FLOW IN CHANNELS WITH POROUS WALLS, by Abraham S. Berman. Issued Nov. 28, 1952. 40p. (K-944)
- K-978** 876
Carbide and Carbon Chemicals Co. (K-25)
AN ANALYTICAL METHOD FOR DETERMINING THE TRANSIENT BEHAVIOR OF MULTIPLE SECTION CASCADES, PART I, by J. E. Rowe. Issued Nov. 25, 1952. 25p. (K-978)
- K-980** 782
Carbide and Carbon Chemicals Co. (K-25)
THE CRYSTAL STRUCTURE OF METHYL CHLORIDE AT -125°C, by R. D. Burbank. Issued Dec. 3, 1952. 12p. (K-980)
- K-981** 994
Massachusetts Inst. of Tech. Engineering Practice School, Oak Ridge
EVOLUTION OF HALIDES FROM HALOGENATED PLASTICS EXPOSED TO GAMMA RADIATION, by J. Byrne and W. L. Mann. Issued Nov. 15, 1952. 24p. (K-981)
- LA-1492** 919
Los Alamos Scientific Lab.
NUMERICAL SOLUTION OF A MINIMUM PROBLEM, by E. Fermi. Nov. 19, 1952. 17p. (LA-1492)
- MTA-2** 889
California Research and Development Co.
NEUTRON-DEFICIENT ISOTOPES OF CESIUM AND BARIUM, by M. Lindner and R. N. Osborne. Oct. 28, 1952. 6p. (MTA-2)
- NYO-893** 836
Rensselaer Polytechnic Inst.
PROGRESS REPORT NO. 1 [ON] ANISOTROPIC DIFFUSION: SELF-DIFFUSION IN ZINC, by H. B. Huntington, G. A. Shirn, and E. S. Wajda. Dec. 1, 1952. 23p. (NYO-893; Progress Report No. 1)
- NYO-923** 837
Massachusetts Inst. of Tech.
TECHNICAL PROGRESS REPORT [ON] THERMODYNAMICS OF METAL SOLUTIONS, SCOPE I, by M. B. Bever, G. Scatchard, and C. Wagner. Nov. 3, 1952. 22p. (NYO-923)
- NYO-3150** 808
Columbia Univ.
BOILING AND CONDENSING OF LIQUID METALS, by C. F. Bonilla. Oct. 24, 1952. 6p. (NYO-3150)
- ORNL-1303** 761
Oak Ridge National Lab.
ANALYSES FOR TOTAL AND ISOTOPIC CARBON IN INTERMEDIARY METABOLISM STUDIES, by David S. Anthony and Mary V. Long. Oct. 31, 1952. 15p. (ORNL-1303)
- ORNL-1389** 899
Oak Ridge National Lab.
INSTRUMENT RESEARCH AND DEVELOPMENT QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JULY 20, 1952. Issued Dec. 9, 1952. 12p. (ORNL-1389)
- ORNL-1395** 810
Oak Ridge National Lab.
FORCED CONVECTION HEAT TRANSFER IN PIPES WITH VOLUME HEAT SOURCES WITHIN THE FLUIDS, by H. F. Poppendiek and L. D. Palmer. Issued Dec. 17, 1952. 39p. (ORNL-1395)

- UCLA-236 737
Atomic Energy Project, Univ. of Calif., Los Angeles
EFFECT OF POTENTIATION OR INHIBITION OF
ACETYLCHOLINE ON INTESTINAL DAMAGE, MORTALITY
AND RECOVERY AFTER ACUTE ABDOMINAL X-RADIA-
TION IN THE RAT, by Lawrence E. Detrick, Bonnie Rhodes,
Virginia Debley, and Thomas J. Haley. Issued Nov. 20,
1952. 14p. (UCLA-236)
- UCLA-237 714
Atomic Energy Project, Univ. of Calif., Los Angeles
A PHARMACOLOGICAL STUDY OF COANESIN, A NEW
HEMOSTATIC? by James L. Leitch, Bonnie M. Rhodes,
Peggy Lenney, and Thomas J. Haley. Dec. 8, 1952. 18p.
(UCLA-237)
- UCRL-1961 793
Radiation Lab., Univ. of Calif., Berkeley
THE SEPARATION AND CHARACTERIZATION OF PHOS-
PHORYLATED COMPOUNDS FROM GREEN PLANTS
(thesis), by Murray Goodman. Sept. 29, 1952. (UCRL-
1961)
- UCRL-1967 977
Radiation Lab., Univ. of Calif., Berkeley
NUCLEAR ABSORPTION CROSS SECTIONS FOR HIGH
ENERGY PROTONS (thesis), by Albert John Kirschbaum.
Oct. 1952. 43p. (UCRL-1967)
- UCRL-1990 762
Radiation Lab., Univ. of Calif., Berkeley
CARBON DIOXIDE FIXATION BY BARLEY ROOTS, by
Leonard W. Poel. Oct. 29, 1952. 14p. (UCRL-1990)
- UCRL-1995 901
Radiation Lab., Univ. of Calif., Berkeley
A CLOUD CHAMBER FOR THE STUDY OF PARTICLES OF
LOW ENERGY, by T. C. Merkle and J. L. Need. Nov. 6,
1952. 12p. (UCRL-1995)
- UCRL-1996 978
Radiation Lab., Univ. of Calif., Berkeley
THE HIGH-ENERGY CHARGED PARTICLES FROM TAR-
GETS BOMBARDED BY 190 MEV DEUTERONS (thesis), by
Larry Schecter. Oct. 28, 1952. 73p. (UCRL-1996)
- UCRL-1998 979
Radiation Lab., Univ. of Calif., Berkeley
ANGULAR DISTRIBUTION OF PHOTONS IN SHOWERS, by
Jack W. Rosengren. Oct. 31, 1952. 24p. (UCRL-1998)
- UCRL-1999 845
Radiation Lab., Univ. of Calif., Berkeley
ANGULAR DISTRIBUTION OF BREMSSTRAHLUNG RADIA-
TION, by Jack W. Rosengren. Nov. 3, 1952. 16p. (UCRL-
1999)
- UCRL-2003 773
Radiation Lab., Univ. of Calif., Berkeley
THE PERMANGANATE OXIDATION OF URACIL AND 5-
NITROURACIL, by J. L. Fairley, L. L. Daus, and B.
Krueckel. Nov. 11, 1952. 5p. (UCRL-2003)
- UCRL-2005 937
Radiation Lab., Univ. of Calif., Berkeley
SPONTANEOUS FISSION RATE OF Cf^{248} , by E. K. Hulet,
S. G. Thompson, and A. Ghiorso. Nov. 6, 1952. 5p.
(UCRL-2005)
- UR-223 763
Atomic Energy Project, Univ. of Rochester
THE METABOLISM OF GLUTARIC ACID-1,5- C^{14} : I. IN
NORMAL AND PHLORIZINIZED RATS, by Morton Rothstein
and Leon L. Miller. Oct. 22, 1952. 16p. (UR-223)
- UR-225 758
Atomic Energy Project, Univ. of Rochester
SELECTED BLOOD AND URINE CHANGES IN EXPERI-
MENTAL BERYLLIUM POISONING, by Charles J. Spiegl,
Leo J. La France, and Betty J. Ashworth. Oct. 31, 1952.
23p. (UR-225)
- OTHER UNCLASSIFIED REPORTS OF SPECIAL
INTEREST TO AEC LABORATORIES
- AERE-M/TN-11 823
Atomic Energy Research Establishment, Harwell, Berks
(England)
A CRITICAL REVIEW OF THE ALLOYING BEHAVIOUR OF
ZIRCONIUM, by P. C. L. Pfeil. June 9, 1952. 26p.
(AERE-M/TN-11)
- AERE-T/M-54 936
Atomic Energy Research Establishment, Harwell, Berks
(England)
USE OF THE LINEAR ACCELERATOR FOR INVESTIGAT-
ING THE NUCLEAR CHARGE DISTRIBUTION, by F. Mandl.
Jan. 1952. 6p. (AERE-T/M-54)
- AF-TR-6595(pt.2) 824
Massachusetts Inst. of Tech.
STUDIES AND EXPERIMENTAL INVESTIGATIONS FOR THE
DEVELOPMENT OF PHASE DIAGRAMS OF THE TITANIUM-
CHROMIUM AND TITANIUM-COPPER ALLOY SYSTEMS:
PART 2. THE TITANIUM-COPPER AND THE TITANIUM-
CHROMIUM PHASE DIAGRAMS, by Arnold S. Joukainen and
Frank B. Cuff. Dec. 1951. 41p. (AF-TR-6595(pt.2))
- AF-TR-6675 825
Aeroprojects, Inc.
ULTRASONICS APPLIED TO SOLIDIFICATION AND SOLID-
STATE TRANSFORMATION, by J. Byron Jones. Oct. 1951.
80p. (AF-TR-6675)
- BRL-834 893
Ballistic Research Labs., Aberdeen Proving Ground
THE ACCURACY OF NUMERICAL SOLUTION OF ORDI-
NARY DIFFERENTIAL EQUATIONS, by Theodore E. Sterne.
Oct. 1952. 11p. (BRL-834)
- ML-173 973
Microwave Lab., Stanford Univ.
PULSERS FOR THE STANFORD LINEAR ELECTRON
ACCELERATORS, by Paul A. Pearson. Nov. 1952. 268p.
(ML-173; U-25434)
- NACA-TN-2771 802
Langley Aeronautical Lab., NACA
THERMAL BUCKLING OF PLATES, by Myron L. Gossard,
Paul Seide, and William M. Roberts. Aug. 1952. 39p.
(NACA-TN-2771)
- NACA-TN-2843 878
Lewis Flight Propulsion Lab., NACA
AUXILIARY EQUIPMENT AND TECHNIQUES FOR ADAPT-
ING THE CONSTANT-TEMPERATURE HOT-WIRE ANE-
MOMETER TO SPECIFIC PROBLEMS IN AIR-FLOW
MEASUREMENTS, by James C. Laurence and L. Gene
Landes. Nov. 1952. 77p. (NACA-TN-2843)
- NBS-1923 879
Office of Basic Instrumentation, National Bureau of Standards
QUARTERLY PROGRESS REPORT OF THE OFFICE OF
BASIC INSTRUMENTATION FOR THE QUARTER ENDING
JUNE 30, 1952. [nd] 97p. (NBS-1923)
- NBS-2080 895
Radiation Physics Lab., National Bureau of Standards
METHODS FOR CURRENT MEASUREMENT WITH A

- VIBRATING REED ELECTROMETER**, by Frank H. Day and Frank H. Atlix. Dec. 1, 1952. 41p. (NBS-2080) 896
- NBS-2080**
Radiation Physics Lab., National Bureau of Standards
CALIBRATION OF GENERAL ELECTRIC GAMMA SURVEY METER OF THE SCINTILLATION PROBE TYPE, by R. A. Elmendorf. Dec. 1, 1952. 6p. (NBS-2086)
- NP-4122** 719
Medical Nutrition Lab., Chicago
EFFECT OF DIET EXPOSED TO CAPACITRON IRRADIATION ON THE GROWTH AND FERTILITY OF THE ALBINO RAT, by Esther DaCosta and Stanley M. Levenson. Dec. 14, 1951. 10p. (NP-4122; Report No. 89)
- NP-4131** 897
Electrona Corp.
SECOND QUARTERLY PROGRESS REPORT [ON] DEVELOPMENT OF RADIACMETER IM-79()/PD COVERING PERIOD MAY 15, 1952 TO AUGUST 15, 1952, by Carl Bosch. [nd] 39p. (NP-4131)
- NP-4165** 826
Metallurgical Advisory Committee on Titanium
INFORMATION BULLETIN NO. T4 [ON] EQUILIBRIUM DIAGRAMS OF TITANIUM ALLOY SYSTEMS. Mar. 1952. 153p. (NP-4165; Information Bulletin No. T4)
- NP-4166** 827
Armour Research Foundation
DEVELOPMENT OF PHASE EQUILIBRIUM DIAGRAMS FOR THE TITANIUM-RICH PORTIONS OF THE TERNARY SYSTEMS Ti-Mn-Al, Ti-Cr-Mo, AND Ti-Mn-Mo; INTERIM TECHNICAL REPORT NO. 3 FOR JUNE 1, 1952-SEPTEMBER 1, 1952. [nd] 29p. (NP-4166; Interim Technical Report No. 3; WAL-401/103-14)
- NP-4178** 779
Engineering Research Inst., Univ. of Mich.
SPECTROCHEMICAL ANALYSIS OF TITANIUM METAL AND ALLOYS; INTERIM REPORT NO. 2, by J. H. Enns. Sept. 1952. 23p. (NP-4178; Interim Report No. 2; U24979)
- NP-4179** 828
New York Univ.
TITANIUM-RICH TERNARY ALLOYS OF TITANIUM WITH CARBON AND NITROGEN, CARBON AND OXYGEN, AND NITROGEN AND OXYGEN; INTERIM TECHNICAL REPORT NO. 1, by L. Stone and H. Margolin. May 15, 1952. 24p. (NP-4179; Interim Technical Report No. 1; WAL-401/85-10; U24993)
- NP-4186** 829
Institute of Engineering Research, Univ. of Calif., Berkeley
EFFECT OF PRESTRAIN HISTORIES ON THE CREEP AND TENSILE PROPERTIES OF ALUMINUM; TWENTY-FIRST TECHNICAL REPORT, by Oleg D. Sherby, Alfred Goldberg, and John E. Dorn. Oct. 1, 1952. 32p. (NP-4186)
- NP-4187** 830
Illinois Inst. of Tech.
PROGRESS REPORT NO. 1 [ON] THE EFFECT OF DISSOLVED ELEMENTS ON THE RATE OF ISOTHERMAL GRAIN GROWTH IN METALS. Oct. 15, 1952. 15p. (NP-4187; Progress Report No. 1)
- NP-4192** 805
Illinois Inst. of Tech.
AXISYMMETRIC FLOW OF AN IDEAL INCOMPRESSIBLE FLUID ABOUT A SOLID TORUS, by E. Sternberg and M. A. Sadowsky. Aug. 1, 1952. 30p. (NP-4192)
- NP-4206** 898
De Paul Univ.
SECOND QUARTERLY PROGRESS REPORT [ON] SCINTILLATION TECHNIQUES APPLIED TO ELECTRON ENERGY STUDIES [FOR] 1 JULY 1952-30 SEPTEMBER 1952, by Edwin J. Schillinger, Jr. [nd] 14p. (NP-4206)
- NP-4218** 806
Massachusetts Inst. of Tech.
BOILING HEAT TRANSFER PROJECT MONTHLY PROGRESS REPORT, by George Henry, Milton W. Raymond, and Joseph B. Walsh. Nov. 1, 1952. 6p. (NP-4218)
- NP-4220** 920
Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro (Brazil)
GAMMA RADIATION EMITTED IN THE PI-MU DECAY, by G. E. A. Fialho and J. Tiomno. 1952. 5p. (NP-4220; Physics Note No. 1)
- NP-4221** 929
Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro (Brazil)
ON THE PSEUDOSCALAR MESON THEORY OF THE DEUTERON, by J. Leite Lopes and R. P. Feynman. 1952. 5p. (NP-4221; Physics Note No. 2)
- NP-4222** 930
Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro (Brazil)
ON THE LOW ENERGY MU-MESONS FROM PI-MESON DECAY, by G. E. A. Fialho. 1952. 5p. (NP-4222; Physics Note No. 3)
- NP-4223** 812
Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro (Brazil)
METHODS OF OBTAINING HIGH VACUUM BY IONIZATION. CONSTRUCTION OF AN "ELECTRONIC PUMP," by Helmut Schwarz. Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro (Brazil) and Brasil Univ., Rio de Janeiro (Brazil). Sept. 1952. 9p. (NP-4223; Physics Note No. 5)
- NP-4225** 880
Research Lab. of Electronics, Mass. Inst. of Tech.
QUARTERLY PROGRESS REPORT [FOR PERIOD ENDING SEPTEMBER 1, 1952], by J. B. Wiesner. Oct. 15, 1952. 71p. (NP-4225)
- NP-4227** 831
Illinois Univ.
STRUCTURAL CHANGES IN INGOT IRON CAUSED BY PLASTIC AND REPEATED STRESSING, by W. J. Love. Nov. 1952. 76p. (NP-4227; Technical Report No. 33)
- NP-4229** 844
Pennsylvania State Coll. School of Mineral Industries
A STUDY OF THE THERMAL EXPANSION OF GLASSES, by M. D. Karkhanavala. Nov. 1952. 24p. (NP-4229; Technical Report No. 53)
- NP-4230** 807
Massachusetts Inst. of Tech.
BOILING HEAT TRANSFER PROJECT; MONTHLY PROGRESS REPORT, by George Henry, Milton W. Raymond, Joseph B. Walsh, and Peter Griffith. Dec. 1, 1952. 26p. (NP-4230)
- NP-4231** 832
[Massachusetts Inst. of Tech.]
MECHANICAL ANISOTROPY IN SOME DUCTILE METALS, by W. A. Backofen and B. B. Hundy. [nd] 25p. (NP-4231)

- NP-4232 780
Department of Mines and Technical Surveys (Canada)
A RATEMETER ASSAY UNIT, by H. R. Hardy. Oct. 14, 1952. 38p. (NP-4232; TR-103/52)
- NP-4236 833
Vanderbilt Univ.
SECOND QUARTERLY REPORT [OF] ARMY ORDNANCE RESEARCH PROJECT AT VANDERBILT UNIVERSITY [ON] IRON-VANADIUM-TITANIUM SYSTEM, by W. P. Fishel. Apr. 1, 1952. 16p. (NP-4236)
- NP-4237 834
[Vanderbilt Univ.]
FINAL REPORT [ON] BASIC RESEARCH IN THE GAMMA IRON REGION OF THE SYSTEM Fe-Ti-V AND Fe-Ti-V-C COVERING THE PERIOD FROM JUNE 28 TO SEPTEMBER 28, by W. P. Fishel. Sept. 28, 1952. 17p. (NP-4237; Progress Report No. 4)
- NP-4238 835
Vanderbilt Univ.
THIRD QUARTERLY REPORT [OF] ARMY ORDNANCE RESEARCH PROJECT AT VANDERBILT UNIVERSITY [ON] IRON-VANADIUM-TITANIUM SYSTEM. [nd] 26p. (NP-4238)
- NP-4250 881
Baird Associates, Inc.
TECHNICAL REPORT COVERING THE PERIOD SEPTEMBER 1 TO DECEMBER 1, 1952, by Bruce H. Billings, David Z. Robinson, Stanley J. Sage, and John R. Welty. [nd] 18p. (NP-4250)
- NP-4270 795
Air Force Radiation Lab., Univ. of Chicago
THE BIOLOGICAL AND MEDICAL ASPECTS OF IONIZING RADIATION: THE INFLUENCE OF NITROGEN MUSTARDS ON CITRIC ACID SYNTHESIS IN VIVO, by Kenneth P. Dubois, Jere Derooin, and Kenneth W. Cochran. Nov. 1952. 5p. (NP-4270; Report No. 1)
- NP-4271 736
School of Aviation Medicine
THE BIOLOGICAL AND MEDICAL ASPECTS OF IONIZING RADIATION: IV. THE EFFECT OF FOLINIC ACID, S.F., ON HEMATOPOIESIS FOLLOWING X-RADIATION, by K. H. Burdick and G. O. Ballengee. Oct. 1952. 7p. (NP-4271; Report No. 4)
- NRL-4065 862
Naval Research Lab.
SURFACE STRUCTURE OF QUARTZ CRYSTALS, by George W. Arnold, Jr. Oct. 31, 1952. 16p. (NRL-4065)
- NRL-4069 1001
Naval Research Lab.
THE COLLECTION OF LONG-LIVED NATURAL RADIOACTIVE PRODUCTS FROM THE ATMOSPHERE, by Peter King, Luther B. Lockhart, Jr., Richard A. Baus, Robert L. Patterson, Jr., Herbert Friedman, and Irving H. Blifford, Jr. Oct. 20, 1952. 11p. (NRL-4069)
- OAR-TR-8 809
Office of Air Research
HEAT PROPAGATION PAST AND FUTURE, by D. G. Samaras. Mar. 1951. 80p. (OAR-TR-8; ATI 167314)
- TEI-271 815
Geological Survey
DOMESTIC PHOSPHATE DEPOSITS, by V. E. McKelvey, J. B. Cathcart, Z. S. Altschuler, R. W. Swanson, and Katherine Lutz. Nov. 1952. 49p., 3 illus. (TEI-271)
- TOI-52-7 900
Technical Operations, Inc.
QUARTERLY PROGRESS REPORT NO. 1 FOR JUNE 15, 1952 THROUGH SEPTEMBER 30, 1952, by A. R. Pearlman and R. R. Smyth. [nd] 22p. (TOI-52-7; Quarterly Progress Report No. 1)
- USNRDL-365 720
Naval Radiological Defense Lab.
PARTIAL-BODY IRRADIATION OF THE RAT WITH 190 MEV DEUTERONS, by M. N. Swift, V. P. Bond, S. T. Taketa, H. O. Anger, and J. A. Sayeg. Aug. 26, 1952. 20p. (USNRDL-365)
- WADC-TR-52-197(pt.2) 785
Minnesota Mining and Manufacturing Co.
SYNTHETIC RUBBERS FROM CARBON-FLUORINE COMPOUNDS, by A. M. Borders. Aug. 1952. 113p. (WADC-TR-52-197(pt.2))

GENERAL

RESEARCH PROGRAMS

712

VINGT-QUATRIÈME RAPPORT ANNUEL. 1950-1951. Bruxelles, Fonds National de la Recherche Scientifique, 1951. (In French)

Chapter 2 of this annual report summarizes the activities of the Institut Interuniversitaire de Physique Nucléaire in supporting research at six Belgian nuclear physics centers (Bruxelles, Gand, Liège, Louvain, Mons, and the Ecole Royale Militaire). Research programs at these institutions on high-voltage generators, technique of nuclear emulsions, cosmic rays, applications of radioactivity, etc., are reviewed briefly. In some cases, publications by staff members are listed. (G.Y.)

BIOLOGY AND MEDICINE

713

Brookhaven National Lab.
FLOW BIREFRINGENCE STUDY OF THE FIBRINOGEN-FIBRIN CONVERSION, by J. K. Backus, M. Laskowski, Jr., H. A. Scheraga, and L. F. Nims. Cornell Univ. and Brookhaven National Lab. [nd] 20p. (BNL-1259)

The effect of pH and hexamethylene glycol on the initial course of thrombin-fibrinogen reaction was studied by means of flow birefringence, supplemented by sedimentation velocity measurements. Data are presented in tabular form and are discussed in detail. (C.R.)

714

Atomic Energy Project, Univ. of Calif., Los Angeles
A PHARMACOLOGICAL STUDY OF COANESIN, A NEW HEMOSTATIC? by James L. Leitch, Bonnie M. Rhodes, Peggy Lenney, and Thomas J. Haley. Dec. 8, 1952. 18p. (UCLA-237)

A pharmacological and toxicological investigation of Coanesin, a mixture of 3-(2'-methylphenoxy)-propane-1,2-diol and 3-(2'-methoxyphenoxy)-propane-1,2-diol revealed the following: The mixture is relatively non-toxic. It has little or no antispasmodic potency compared to atropine. It apparently sensitizes the isolated rabbit ileum to cholinergic stimulants. It exhibits a progressively increasing negative inotropic effect upon the isolated perfused mammalian heart. It produces a transient hypotension and bradycardia in the dog, and the latter effect can be partially blocked by atropine. It produces a transient apnea which increases with each subsequent dose until respiratory paralysis occurs. It has a slight antiheparin action in vitro and no effect on blood coagulation in vivo. This latter effect indicates that rabbits do not respond to Coanesin in the same manner as dogs and humans insofar as the blood-coagulation process is concerned. (auth)

RADIATION EFFECTS

715

Cancer Research Inst., New England Deaconess Hospital, Boston
THE ULTRAVIOLET MICROSCOPY OF THE LIVING CELL'S

RESPONSE TO LETHAL X-RADIATION, by P. O'B. Montgomery and Shields Warren. [nd] 9p (AECU-2294)

The effects of 47,000 to 60,000 r of x radiation on Walker rat carcinoma 256 cells in tissue culture as recorded by the Polaroid color-translating ultraviolet microscope are presented. A marked and constant change is produced in the x-radiated cultures from 48 through 120 hr. The interpretation of this dramatic change is discussed. (auth)

716

Johns Hopkins Univ.
MODIFICATION, THROUGH THE USE OF SUPPLEMENTARY ENVIRONMENTAL FACTORS, OF THE FREQUENCY AND TYPES OF GENE AND CHROMOSOME CHANGES INDUCED BY X-RAYS, ULTRAVIOLET LIGHT, AND NITROGEN MUSTARD, by W. D. McElroy and C. P. Swanson. Issued Nov. 15, 1951. 9p. (AECU-2295)

Evidence is presented indicating that the delayed effects of mutagenic agents on the frequency and types of gene and chromosome changes are due to the presence of semi-activated, or metastable, states formed in various parts of the chromosome. Studies of the delayed effects of ultraviolet radiation, the effects of temperature on the delayed effects of nitrogen mustard, the effects of pressure on the changes of specific loci, infrared and x-ray combination studies, infrared absorption studies, infrared dosage and intensity studies, and studies of mutagenic effects of nitrogen mustard on chromosomes of *Aspergillus* and *Neurospora* are reported briefly. (C.R.)

717

Brookhaven National Lab.
VARIATIONS IN THE FLORAL MORPHOLOGY OF NORMAL AND IRRADIATED PLANTS OF *TRADESCANTIA PALUDOSA*, by James E. Gunkel, Ielene B. Morrow, Arnold H. Sparrow, and Eric Christensen. [nd] 21p. (BNL-1285)

Gross aspects of the flower development in both γ -irradiated and non-irradiated plants of *Tradescantia paludosa* are described. (C.R.)

718

Brookhaven National Lab.
THE EFFECT OF IONIZING RADIATIONS UPON THE RESPIRATION AND OXIDASES OF THE POTATO TUBER, by Alfred S. Sussman, Michigan Univ. and Brookhaven National Lab. [nd] 25p. (BNL-1299)

Potato tubers show increases in Q_{O_2} up to 60% as a result of γ irradiation over a wide range of dosages. Carbon dioxide evolution is also increased although the peak of this increase occurs 24 hours after that of the oxygen uptake. Cytochrome oxidase and tyrosinase activities were not affected by the dosages used in these experiments except that the latter enzyme lost half of its activity at 3,200,000 r. (auth)

719

Medical Nutrition Lab., Chicago
EFFECT OF DIET EXPOSED TO CAPACITRON IRRADIATION ON THE GROWTH AND FERTILITY OF THE ALBINO RAT, by Esther DaCosta and Stanley M. Levenson. Dec. 14, 1951. 10p. (NP-4122; Report No. 89)

Growth was maintained in four generations of rats fed a diet normally adequate, but irradiated by high intensity beta rays for one-millionth of a second. Fertility was somewhat

impaired, especially in the male, but more significantly the mortality per litter was markedly increased. (auth)

120

Naval Radiological Defense Lab.

PARTIAL-BODY IRRADIATION OF THE RAT WITH 190 MEV DEUTERONS, by M. N. Swift, V. P. Bond, S. T. Taketa, H. O. Anger, and J. A. Sayeg. Aug. 26, 1952. 20p. (USNRDL-365)

A high-energy (190 Mev) deuteron beam of $\frac{7}{8}$ and $\frac{3}{4}$ inch diameter was used to obtain essentially uniform depth dose irradiation of various anatomical regions of the intact unanesthetized rat not exceeding 5 per cent of the total body weight. Descriptions are given of the syndromes resulting from lateral and anteroposterior exposure of several different abdominal regions and lateral exposure of the chest with doses ranging from 864 to 5076 rep. The relation of acute morbidity and mortality following irradiation of the abdomen with the amount and type of gastrointestinal tissue in the exposure field is discussed. Etiology of the syndrome resulting from exposure of relatively small portions of the abdomen is contrasted with that following irradiation of large portions or all of the abdomen. Chronic ulcerative bowel lesions, appearing three to seven months after abdominal irradiation, are described. (auth)

721

EFFECTS OF TOTAL BODY X-RADIATION ON SALIVARY COMPONENTS OF DOGS. R. S. Leopold, J. L. Nemes, and M. G. Wheatcroft. *J. Dental Research* 31, 603-8(1952) Oct.

722

EFFECT OF RADIATION ON THE BLOOD. Margaret D. Stelling. *Radiography* 18, 221-31(1952) Nov.

The normal constituents of the blood, and the functions of each, are reviewed. Changes produced in the blood, and blood-forming tissues, of patients undergoing radiation therapy are discussed. (C.R.)

723

EFFECTS OF X IRRADIATION ON CONNECTIVE BASOPHIL GRANULAR CELLS (MAST CELLS) OF HUMAN SKIN. Alessandro Novaro. *Radioterapia radiobiol. e fis. med.* 8, 69-74(1952). (In Italian)

Normal human skin was exposed to 1500 to 3000 r of x rays, then fixed in alcohol and basic Pb acetate. Changes in the mast cells are described and illustrated. (G.Y.)

724

ON DISTANCE EFFECTS IN THE ANIMAL ORGANISM FOLLOWING LOCAL X IRRADIATION. H. Langendorff and W. Lorenz. *Strahlentherapie* 88, 177-89(1952). (In German)

After local x irradiations (3000 r over 1 to 3 cm) of the pituitary, testicles, or thigh, an effect at distance is produced on the nonirradiated cortex of the suprarenal gland. This effect consists of considerable changes of the contents in lipids and plasmals as well as large variations of the nuclear volumes and concomitant decrease of lymphocytes, proving that the local x irradiations produce a strong stress. (auth)

725

THE COMPONENTS WITH LETHAL EFFECT ON MICE OF THE TOTAL RADIATION OF A URANIUM PILE. André Ertaud and Paul Bonét-Maury. *Compt. rend.* 235, 909-11(1952) Oct. 20. (In French)

Calculation of the various components (thermal neutrons, fast neutrons, γ rays, induced radioactivity) of pile radiation leads to a value of the lethal dose in good agreement with that evaluated biologically from the mean survival of mice irradiated in Al or Cd cages. (tr-auth)

726

ULTRAFRACTIONATION. II. ADDITIONAL EXPERIMENTAL STUDIES OF THE BIOLOGICAL EFFECT OF AN

INTERMITTENT X IRRADIATION. E. Witte and R. Sigmund. *Strahlentherapie* 88, 384-94(1952). (In German) (cf. NSA 4-6268)

Additional investigations on intermittent x irradiation of *Drosophila* eggs and pupae are reported. Although the previously observed ultrafractionation effect was reproduced in the pupae, no effect was observed in 4.5 ± 0.25 -hr-old eggs for single irradiation times between 1 sec and 4×10^{-5} sec. If such an effect exists for eggs it must appear at shorter irradiation times than 4×10^{-5} sec. Significance of the ultrafractionation effect for explaining the biological action of betatron radiation is discussed. (G.Y.)

727

RADIOACTIVITY INDUCED IN TISSUES BY BETATRON RADIATION. G. Joyet. *Oncologia* 5, 1-12(1952). (In German)

The bremsstrahlung of the 31-Mev betatron induces in tissues certain radioisotopes, of which the most important are O^{15} , C^{11} , N^{13} , P^{30} , I^{128} , I^{126} , and those from the irradiation of Ca. The striated musculature and the field of irradiation at the surface of the skin have activity curves that confirm the two principal periods of 2.1 and 20.5 min due to O^{15} and C^{11} . A long period of 32 hr in the bones is attributed to K^{43} from Ca. The specific activities of radioelements produced have been determined separately with an apparatus for absolute β counting. The specific activity induced at 100 cm from the target with an irradiation of 20 min, which delivers a dose of 730 r, is about 0.1 mc/gram-element for C^{11} and N^{13} , 0.26 mc for O^{15} , 0.2 mc for P^{30} , and 0.006 mc for I^{128} . The dose of supplementary radiation due to the artificial radioactivity induced is of the order of 0.0005 of the dose of direct radiation measured with the ionization chamber at the maximum of the transition curve. The radioactivity induced may allow the direct determination in the tissues of certain elements and, for instance, give the ratio of O to C. (auth)

728

PROBLEM OF THE PHYSICAL EXPLANATION OF DIFFERENT TIME-FACTOR EFFECTS IN BIOLOGICAL OBJECTS. Richard Kurt Kepp and Kurt Müller. *Strahlentherapie* 88, 139-49(1952). (In German)

The so-called time factor in radiation biology is shown to depend on the mean density of ionization by the applied radiation in such a way that the time necessary for a certain degree of restitution after a number of hits is dependent on the number of ionizations of which each hit consists. The conclusion is drawn that, for radiations of different mean densities of ionization, the same dose can result in important differences in selective effects on malignant tissue. (auth)

729

COLD STERILISATION. W. Summer. *Mfg. Chemist* 23, 451-5(1952) Nov.

Problems associated with the use of high-velocity electrons to achieve cold sterilization of medical products are reviewed. Advantages of cold sterilization to the manufacturer or processor of pharmaceuticals and other perishable goods are stressed. Sterilization without any appreciable rise in temperature, the feasibility of bulk sterilization, sterilization of completely packaged goods in sealed containers, and the shortness of sterilization time which makes a continuous process feasible are advantages pointed out. The high initial cost of a β source of requisite energy, special buildings, and equipment is discussed. (C.R.)

730

PROTEIN MODIFICATIONS IN THE SERUM OF PATIENTS WITH UTERINE AND VAGINAL NEOPLASMS DURING RADIUM AND ROENTGEN THERAPY. G. Grassi.

Quaderni clin. ostet. e ginecol. 7, 349-68(1952). (In Italian)

Changes in total protein and the various albumin and globulin fractions during Ra and x-ray treatment of 14 patients are tabulated as part of each case history. (G.Y.)

731

A QUANTITATIVE STUDY OF THE EFFECTS OF X RADIATION ON CELLS IN VITRO. Thomas R. Reid and Margaret P. Gifford. J. Natl. Cancer Inst. 13, 431-39(1952) Oct.

Results of the application of a quantitative method for the determination of cell population in tissue cultures to studies of dose-response patterns following x irradiation is reported. The response to 250, 500, 750, 1000, and 2000 r is described. It was found that recovery occurs following doses of 250 and 500 r whereas 1000 and 2000 r are lethal, and 750 r represents a partially lethal dose. (auth)

732

RADIATION-INDUCED MUTATIONS IN WHEAT AND BARLEY. T. J. Arnason, C. O. Person, and J. M. Naylor. Can. J. Botany. 30, 743-54(1952) Nov.

The effectiveness of absorbed radiophosphorus for mutation induction in wheat and barley has been studied. The P^{32} was supplied to seedlings and to young plants. Chromosome aberrations found in groups of several cells at meiosis were counted but single cell aberrations were not. Following some dosages of P^{32} , as many as one-third of the treated plants were found to have blocks or clusters of aberrant cells. Samples of R_1 (progeny of treated) plants of vulgare wheat and of common barley were also examined for the presence of chromosome aberrations at meiosis. The samples consisted of 143 wheat and 128 barley plants. Approximately 8 to 19% of wheat and 6 to 11% of barley plants of different treatment groups had aberrations. Phenotypic mutants were found in barley, einkorn, and vulgare wheat. Chlorophyll mutants occurred in all of these though no albinos were produced in vulgare. The R_1 and R_2 of vulgare, consisting of 10,443 plants from 258 treated R_1 plants, included 15 recognized mutants. The original mutants did not breed true. Offspring of some mutants included only mutant and normal-appearing plants. Other mutants gave a variety of new phenotypic forms; some of these are true-breeding. Nearly all of the wheat mutants gave evidence of chromosome aberrations. Most of the phenotypic changes are therefore attributed to changed gene balance rather than to gene mutation. A few mutations have also been obtained by irradiating wheat and barley seeds with high-energy x rays from the betatron. Two such mutants in wheat were found to have undergone chromosome breakage and rearrangement. (auth)

733

USE OF FISSION PRODUCTS FOR INSECT CONTROL. Charles C. Hassett and Dale W. Jenkins. Nucleonics 10, No. 12, 42-6(1952) Dec.

Results are given of tests subjecting six species of insects to Co^{60} γ rays. Reproduction was inhibited with 16,000 to 32,000 r, and 64,400-r doses were found to be completely lethal. This investigation is considered as preliminary to tests with reactor wastes, inasmuch as it was deemed necessary to first determine the lethal dose. 13 references. (L.M.T.)

RADIATION HAZARDS AND PROTECTION

734

Oak Ridge National Lab.
MAXIMUM PERMISSIBLE NEUTRON FLUX FOR FAST AND THERMAL NEUTRONS, by W. S. Snyder and J. Neufeld. [nd] 1p. (AECU-2328)

A 30-cm slab of tissue is taken as model for the human body and is considered as irradiated by a normally directed

beam of neutrons, with 1 n/cm²/sec entering the slab. The resulting collision density is calculated for a beam of thermal neutrons, and also for beams of fast neutrons of energies 10, 5, 2.5, 0.5, and 0.005 Mev. The calculation of a dosage curve from the collision density involves the conversion to rep and this has been effected here by assuming the RBE factor to be 1 for gamma rays, 10 for protons, and 20 for any particles heavier than protons. In the thermal calculation the neutrons are assumed to be constant in energy and the scattering is taken as isotropic in the laboratory system of coordinates. This leads to an integral equation which can then be solved to determine the collision density. The production of protons and gamma rays from the (n-p) and (n- γ) reactions, respectively, is then calculated and converted to reps to give a dosage curve. This curve has a peak, some 3 mm within the slab, and then falls off quite rapidly. The peak is about 30% higher than the value at the surface. This theoretical curve agrees quite well with the experimental curve determined by Smith and Tait (Nature 165, 196(1950)). The maximum permissible flux is found to be about 1800 n/cm²/sec based on a 40-hour week. The calculation of the collision density for the fast neutron beams is much more difficult since the cross sections are energy dependent and scattering is no longer isotropic. For fast neutron beams, the calculation has been made by the Monte Carlo method. The resulting energy losses are calculated from this collision density and yield a dosage curve which, for high energies, has its peak at or near the surface. The dosage curve for the 10-Mev beam has a fairly flat plateau extending into the slab for several centimeters. Since the Monte Carlo method is statistical in nature the dosage curve calculated by this method necessarily involves sampling errors and, hence, cannot be trusted in fine detail. The statistics indicate accuracy of the order of 10 to 15% for the curve. The method does enable us to obtain much detailed information. For example, collisions with elements other than hydrogen account for about 10% of the energy losses in the 10-Mev beam, and thus are not negligible. Since the neutrons are followed to thermal or near thermal energies, it is possible to get the resulting thermal distribution and to calculate its contribution to the damage. This is quite negligible for the high energy beams, but at 0.005 Mev amounts to more than half the total dose. The maximum permissible flux based on a 40-hour week is found to be about 25, 24, 38, 82, and 1640 n/cm²/sec for beams of energies 10, 5, 2.5, 0.5, and 0.005 Mev, respectively. (Entire report)

735

Oak Ridge National Lab.
SAMPLING METHODS AND REQUIREMENTS FOR ESTIMATING AIRBORNE RADIOPARTICULATE HAZARDS, by Thomas J. Burnett. Nov. 21, 1952. 57p. (CF-52-11-1)

A study was made of the proper criteria for a sampling and evaluation method with which to appraise the biological hazard from airborne radioactive material. Current instruments and techniques do not provide needed data in a satisfactory form for practical use. Principal concern is with internal exposure from insoluble beta-emitting particulate air contaminants. Particle-size distribution parameters are critical because of size-selective lung site retention. Upper respiratory and alveolar clearance rates and mechanisms also differ. Given a mean particle diameter (0.3 μ), variation in standard deviation from 2.0 to 3.66 increases the airborne mass and submersion dose 216-fold (particle number content). Upper respiratory retention increases by a factor of 5.3, alveolar retention decreases by a factor of 1/16.2, and percent exhaled decreases by a factor of 1/30. The

recommended sample collection method uses two filters to separate size fractions simulating respiratory retention. Appropriate areas, flow rates, and sampling times are used. For evaluation, the comparative gross activity counts are indicative of particle size distribution and probable exposure levels. Counting with absorbers gives necessary energy-range data and recounts provide decay rates. The filter samples, in approximately 30-min x-ray film exposures, produce spots of diameters proportional to the significant particle activity sizes. A size count of such spots indicates the number and intensity of exposure foci. Leaching the filters permits the determination of soluble activity. (auth)

736

School of Aviation Medicine

THE BIOLOGICAL AND MEDICAL ASPECTS OF IONIZING RADIATION: IV. THE EFFECT OF FOLINIC ACID, S.F., ON HEMATOPOIESIS FOLLOWING X-RADIATION, by K. H. Burdick and G. O. Ballengee. Oct. 1952. 7p. (NP-4271; Report No. 4)

Thirty male white rats were exposed to 570 r of x radiation. The first group of 10 animals served as untreated controls. The second group of 10 received 1 mg of folinic acid, one-half hour before irradiation and 0.5 mg daily for twenty days. In the third group, 5 rats were given 5 mg of folinic acid twenty-four hours after irradiation and 0.5 mg daily for twenty days. The fourth group received only 0.5 mg twenty-four hours after irradiation. Under the procedure employed, folinic acid was found to be ineffective as a stimulant of hematopoiesis following impairment by irradiation. (auth)

737

Atomic Energy Project, Univ. of Calif., Los Angeles
EFFECT OF POTENTIATION OR INHIBITION OF ACETYLCHOLINE ON INTESTINAL DAMAGE, MORTALITY AND RECOVERY AFTER ACUTE ABDOMINAL X-RADIATION IN THE RAT, by Lawrence E. Detrick, Bonnie Rhodes, Virginia Debley, and Thomas J. Haley. Issued Nov. 20, 1952. 14p. (UCLA-236)

Under the conditions of this experiment, autonomic drug medication employing atropine sulfate, neostigmine methyl bromide, tetraethylammonium chloride, dibenamine hydrochloride and nicotine did not prolong the survival time or decrease mortality above that observed in saline treated animals following x-irradiation of the abdomen. Atropine medication not only failed to give protection but actually increased the rate of and total mortality. No histological changes were observed in the intestinal sections that could be attributed to the respective drug medication. Furthermore, a histological criterion of drug medication efficacy was unsatisfactory because of the rapid "turnover" of the intestinal epithelium. (auth)

738

RADIATION PROTECTION—PROTECTING THE PATIENT. S. B. Osborn. *Radiography* 18, 232-9(1952) Nov.

The need for protecting patients from over-exposure during diagnostic and therapeutic exposure to radiations is discussed. Techniques which should be employed for the protection of both the patient and the operator are reviewed. (C.R.)

739

A NEW PROTECTIVE AGENT AGAINST X RADIATION. Z. M. Bacq and A. Herve. *Schweiz. med. Wochschr.* 82, 1018-20(1952) Oct. 4. (In French)

The doses and respective survival rates of mice injected intraperitoneally with numerous amines or amino acids or various salts of histamine before a 700-r irradiation are tabulated. The frequent superior protective effect of an amine over the corresponding amino acid, as cysteinamine

(HSCH₂CH₂NH₂) over cysteine, is noted. The former compound, also called β -mercaptoethylamine or 2-aminoethanethiol, may have important value in therapy of human radiation sickness. (G.Y.)

740

COMPARATIVE ACTION OF CORTISONE, DESOXYCORTICOSTERONE, AND PROMETHAZINE ON THE RESISTANCE OF ADRENALECTOMIZED ANIMALS TO X RAYS. B. N. Halpern, A. Cuendet, and J. P. May. *Schweiz. med. Wochschr.* 82, 1020-3(1952) Oct. 4. (In French)

Experiments with rats show that adrenalectomy triples the sensitivity to x rays. During the development of the radiation morbidity and mortality, two phases can be distinguished: a cytotoxic phase during the first 8 days and an infectious phase after the first week. Cortisone exerts a protective action during the first phase, but increases the mortality from infections during the second. Desoxycorticosterone has a similar but weaker effect. Antihistaminic drugs, notably promethazine, do not possess any protective power, and in fact aggravate the radiation injuries in the adrenalectomized animals. (tr-auth)

741

AERIAL SURVEYING FOR RADIOACTIVE GROUND CONTAMINATION. D. M. Davis, J. C. Hart, and K. Z. Morgan. *Nucleonics* 10, No. 11, 75-9(1952) Nov.

Preliminary experiments were made to test the practicability of using light aircraft and commercially available radiation-detection instruments to survey the ground for radioactive contamination. Tests employing radioactive Co, Cs, Na, and Ta indicate that light aircraft and commercial G-M survey meters provide a feasible method for surveying large ground areas. (L.T.W.)

742

THE ROLE OF THE ADRENAL IN THE GENERAL RESISTANCE OF THE ORGANISM TO RADIATIONS. H. Betz. *J. belge radiol.* 35, 380-92(1952). (In French)

Experiments on the protective effect in mice of KCN and other drugs against a lethal dose of x rays are reported. The chemicals strongly inhibit the typical decrease of cortico-adrenal lipids and the increase of hepatic lipids in irradiated mice. Death of irradiated animals is attributed, therefore, to a general disturbance of the adaptation syndrome, rather than to radiolesions. It is possible to produce a specific resistance to x rays by prior sublethal irradiation. Although less effective, a nonspecific resistance can be established by exposure to other stresses, such as cold or repeated injections of ACTH. However, administration of ACTH following irradiation hastens death by aggravating the adrenal depletion. (G.Y.)

RADIATION SICKNESS

743

HISTAMINE: ANTIHISTAMINES: AND RADIATION SICKNESS; REVIEW AND EXPERIMENTAL RESEARCH. Dino A. Scala. *Radioterapia radiobiol. e fis. med.* 8, 30-51(1952). (In Italian)

The therapeutic effects of numerous synthetic antihistamines on radiation sickness are reviewed briefly, and 35 condensed case histories of patients treated with Thephorin for radiation sickness resulting from x-ray therapy of various neoplasms are presented. Hypotheses as to the mechanism of antihistaminic effects are considered, and the therapeutic use of vitamin B₆ in association with antihistamines is suggested. 45 references. (G.Y.)

744

SURVIVAL AFTER RADIATION EXPOSURE—INFLUENCE OF A DISTURBED ENVIRONMENT. Willie W. Smith. *Nucleonics* 10, No. 11, 80-3(1952) Nov.

Irradiated mice and rats were subjected to fatiguing exercise, poor diet, and infection in experiments to evaluate the effects of conditions expected to follow an atomic-weapon attack. It was found that moderate exercise, moderate degrees of stress, and no food or a poor diet for a short time can be tolerated under laboratory conditions by the species studied. Extremes of exercise or cold are not so well tolerated. The bleeding tendency does not appear for several days and by then the environmental conditions should be fairly well controlled. A high degree of susceptibility to infection appears within a few days and may last for several weeks. (L.T.W.)

RADIOGRAPHY

745

IS AUTORADIOGRAPHY APPLICABLE AS A HISTOLOGICAL INVESTIGATION METHOD? W. Bejdl. *Anat. Anz.* 99, 124-9 (1952). (In German)

Difficulties, centered in the availability of isotopes, sensitivity of the emulsions used, and above all in the structure of organs, in applying autoradiography to studies of fine morphology are discussed. (G.Y.)

746

RADIOGRAPHIC INVESTIGATION ON THE VASCULAR SYSTEM OF RABBIT EARS. W. Röhrli. *Strahlentherapie* 88, 276-307(1952). (In German)

Functional changes produced in the vascular system of rabbit ears by exposure to artificial sunlight, x rays, or ultrasound have been studied by macro and micro radiological methods. 32 figures. (G.Y.)

RADIOTHERAPY

747

Brookhaven National Lab.

DOSIMETRIC CONSIDERATIONS IN DETERMINING HEMATOPOIETIC DAMAGE FROM RADIOACTIVE IODINE, by J. E. Rall, Charles G. Foster, Jacob Robbins, R. Lazerson, Lee E. Farr, and Rulon W. Rawson. Brookhaven National Lab. and Sloan-Kettering Inst. for Cancer Research and Memorial Center, New York. [nd] 21p. (BNL-1278)

Thirty-three patients have been studied with tracer and very large therapeutic doses of I^{131} . The lymphocyte count has been found to be the most sensitive and reliable index of the degree of radiation damage. The lymphocyte fall after large doses of I^{131} is not well correlated with the millicuries of the isotope administered but is very well (correlation coefficient 0.919) correlated with the integrated blood concentration of this isotope plus an empirical factor derived from the integrated amount of isotope retained in the body. In patients retaining in 48 hours less than 115 millicuries of radioiodine it has been possible to predict from tracer studies the amount of radiation that a large dose of I^{131} will deliver. (auth)

748

EXPERIMENTAL RADIOTHERAPY OF ABDOMINAL CANCER. II. EFFECT OF A FLAVONONE (RUTIN) ON RADIATION REACTIONS. Annabelle Cohen and Lionel Cohen. *Brit. J. Radiology* 25, 601-5(1952) Nov.

749

FUNDAMENTALS OF INTRAUTERINE BETA RADIATION THERAPY WITH ARTIFICIAL RADIOACTIVE ISOTOPES. H. A. Kunkel, H. J. Schmermund, and G. Schubert. *Geburtshilfe u. Frauenheilk.* 12, 695-708(1952) Aug. (In German)

Development of applicators, selection of suitable isotopes, and dosimetry techniques in β -ray therapy of the uterus are

discussed. Histological effects of P^{32} radiation on the endometrium, as observed in three patients, are described. (G.Y.)

750

SOME CONSIDERATIONS ON A CASE OF RADIOIODINE 131 -TREATED CARCINOMA COMPLICATED BY PULMONARY TUBERCULOSIS AND CARDIAC INSUFFICIENCY. M. Clo-suit. *J. belge radiol.* 35, 373-9(1952). (In French)

A 72-yr-old female patient with pulmonary tuberculosis and a cardiac insufficiency was treated with repeated doses of I^{131} , totaling 50 mc over 9 months, for thyroid carcinoma with pulmonary metastases. Excellent response to the treatment was noted. Almost complete disappearance of metastases and a regular increase in weight were noted. There was no aggravation of the cardiac condition nor any appearance of myxedema. (G.Y.)

751

COLLOIDAL CHROMIC RADIOPHOSPHATE IN HIGH YIELDS FOR RADIOTHERAPY. M. E. Morton. *Nucleonics* 10, No. 11, 92-6(1952) Nov.

Radioactive P is added to a standardized H_3PO_4 solution, followed by addition of standardized chromic-nitrate solution. The mixture is evaporated to dryness and left in a furnace overnight at 500°C. After cooling, the sample is removed from the furnace, and stainless-steel balls and pyrogen-free distilled water are added. The sample is ground for one day, yielding particles less than one μ in diameter. Continuous grinding for 2 to 3 days produces particles as small as 100 m μ in diameter. After autoclaving, dilution with sterile saline may be carried out. Hyaluronidase may be added to promote diffusion when interstitial injections are made. Epinephrine may be used to produce local vasoconstriction. (L.T.W.)

752

ARTHRITIC AND RHEUMATOID PHENOMENA IN RADIOIODINE (I^{131}) TREATED THYROTOXICOSIS. A CONTRIBUTION TO THE QUESTION OF THYROID-ADRENAL CORTEX INTERACTION. R. Prévôt and W. Horst. *Strahlentherapie* 88, 253-60(1952). (In German)

One hundred patients suffering from medium-serious to serious thyrotoxicosis were treated with I^{131} ; in 92 cases, the treatment was definitely successful. The dosage was determined according to roentgen equivalents per gram of thyroid tissue. One myxedema and two cases of hypothyreosis were observed. Temporary rheumatoid or polyarthritic troubles were observed in 13 patients, of which three proved to be strongly marked. These phenomena are considered to be the expression of a reciprocal action between the thyroid gland and the cortex of the suprarenal gland; they appear during the destruction of the thyroid function and can, at least partly, be interpreted as disturbance of the compensation of a disguised adaptation syndrome according to Selye. In the author's opinion, these observations do not restrict the indication toward therapeutic application of radioiodine. In special cases, it will be more advantageous to fractionize the radioressection and to preserve one of the thyroid functions at the upper limit of the norm. (auth)

753

RADIOACTIVE PHOSPHORUS IN THE TREATMENT OF MYELOID LEUKEMIA. Georges Marchal. *Therapie* 7, 301-2(1952). (In French)

A case history of myeloid leukemia in which remissions were obtained following each of several series of P^{32} injections and teleroentgentherapy is presented. The periods of latence and retarded effects were longer with P^{32} therapy than with teleroentgentherapy, but the quality of the remissions seemed the same. (G.Y.)

754

APPLICATION AND ACTION OF PETEOSTHOR IN PULMONARY AND EXTRAPULMONARY TUBERCULOSIS IN CHILDHOOD: WITH A GENERAL CRITIQUE OF THORIUM X AND PETEOSTHOR THERAPY. Heinz Spiess. Z. Kinderheilk. 70, 213-52(1952). (In German)

755

THE PALLIATIVE TREATMENT OF MALIGNANT PLEURAL AND PERITONEAL EFFUSIONS WITH RADIO-ACTIVE COLLOIDAL GOLD. R. J. Walton. J. Faculty Radiol. 4, 130-33(1952) Oct.

Results obtained in 39 cases indicate that colloidal Au¹⁹⁸ treatment is well worth a trial as a palliative measure in many cases of malignant effusion. As a curative procedure, in combination with surgery and conventional radiotherapy, it may help to reduce the recurrence rate in carcinoma of the ovary. (C.R.)

756

UTILIZATION OF PHOSPHORUS-32 IN OSTEOSARCOMAS (FOUR OBSERVATIONS). René Huguenin and Julien Guelfi. Bull. assoc. franç. étude cancer 39, 256-60(1952). (In French)

Four case histories of patients treated internally with P³² for osteosarcomas and bone metastases are reported. While recent metastases can be expected to respond to this treatment, P³² is not a sovereign remedy. (G.Y.)

757

PHOSPHORUS-32 AND SOME METASTASES OF BREAST CANCER (SIX OBSERVATIONS). René Huguenin and Julien Guelfi. Bull. assoc. franç. étude cancer 39, 250-5(1952). (In French).

Six case histories of patients treated internally with P³² for bone and skin metastases following operation for breast cancer are reported. The importance of the carrier molecule on elimination of P³² is noted. (G.Y.)

TOXICOLOGY STUDIES

758

Atomic Energy Project, Univ. of Rochester
SELECTED BLOOD AND URINE CHANGES IN EXPERIMENTAL BERYLLIUM POISONING, by Charles J. Spiegel, Leo J. La France, and Betty J. Ashworth. Oct. 31, 1952. 23p. (UR-225)

Laboratory tests for the early diagnosis of Be poisoning were investigated. Methods are given for analysis of the lipid partition pattern of blood. Control values for the rabbit and for the phospholipids and free cholesterol of the red cell of the dog are included. The ratio of phospholipid to free cholesterol in the red cells decreased following a single intravenous injection of BeSO₄ in each of 5 dogs in doses of from 25 µg Be/kg to 400 µg Be/kg. The changes were moderately significant and showed a correlation with the dose. The lipid ratio likewise decreased during daily inhalation of BeSO₄ at a concentration of 1.5 mg Be/m³ by 5 dogs and showed a continued downward trend through the end of the experiment at 35 days. The ratio of urinary uric acid to creatinine was considerably elevated in 3 dogs exposed by inhalation to BeF₂ at a level of 1 mg Be/m³ throughout the 80 days of the exposure. Values dropped to normal within 7 days after the conclusion of beryllium inhalation. Control values and standard deviations are given. The increases in urinary uric acid to creatinine showed a close parallelism with exposure in another experiment in which 2 dogs inhaled BeF₂. (auth)

759

HEMATOLOGICAL MODIFICATIONS BY BERYLLIUM OXIDE; EXPERIMENTAL STUDIES. A. Masoero. Rass. med. ind. 21, 155-65(1952) Mar.-Apr. (In Italian)

Adult guinea pigs were injected subcutaneously with daily

doses of 3 mg of BeO/kg of body weight for 40 days. Complete blood pictures at 7, 14, 21, 28, and 40 days are presented. (G.Y.)

760

EXPERIMENTAL STUDIES IN METAL CANCERIGENESIS. II. EXPERIMENTAL URANIUM CANCERS IN RATS. W. C. Hueper, J. H. Zuefle, A. M. Link and M. G. Johnson. J. Nat. Cancer Inst. 13, 291-305(1952) Oct.

1. The deposition of approximately 50 mg of U into the marrow cavity of a femur resulted in the development of 11 sarcomas at the site of injection among 33 rats, of which 30 survived the minimal latent period of 6 months. The intrapleural administration of approximately 300 mg of U, given in 6 monthly injections, caused the appearance of 2 sarcomas originating from the chest wall among 33 rats thus treated. Two of the 13 sarcomas were bone-forming, and 6 produced metastases in the inguinal, abdominal, or mediastinal lymph nodes and/or the lungs. All sarcomas either surrounded uranium deposits or were found in the immediate vicinity of them. It is uncertain whether the sarcomas were due to a metalcarcinogenic action of uranium or were caused by a radiocarcinogenic effect of this radioactive chemical. The observations reported demonstrate that localized U deposits in the tissues of rats, creating a high concentration of U in circumscribed areas, and the prolonged action of the U in "nontoxic" or low-toxic quantities on the cells in the immediate vicinity of such foci, exert a definite carcinogenic effect. None of the 13 sarcomas seemed to originate from the endosteum. The sarcomas appeared either to be of periosteal origin or to stem from mesodermal elements of the thigh muscle. (auth)

TRACER APPLICATIONS

761

Oak Ridge National Lab.
ANALYSES FOR TOTAL AND ISOTOPIC CARBON IN INTERMEDIARY METABOLISM STUDIES, by David S. Anthony and Mary V. Long. Oct. 31, 1952. 15p. (ORNL-1303)

Methods for the determination of total C and of isotopic C in intermediary metabolism studies are reviewed. Evaluations are included of the accuracy and precision of total-C analysis by wet oxidation, the precision of C¹⁴ specific activity determinations using solid counting with mica end-window counters, and the precision of C¹⁴ specific activity determinations using gas ionization chambers for counting after conversion of the sample to CO₂. (C.R.)

762

Radiation Lab., Univ. of Calif., Berkeley
CARBON DIOXIDE FIXATION BY BARLEY ROOTS, by Leonard W. Poel. Oct. 29, 1952. 14p. (UCRL-1990)

The non-volatile, 80% ethanol-soluble products of fixation have been investigated in excised roots, using C¹⁴O₂ and radiochromatography. The main radioactive compounds separated were malic, citric (or iso-citric), aspartic and glutamic acids, asparagine and glutamine. Less activity was present in serine, tyrosine, α-ketoglutaric acid and alanine, and in a number of unidentified compounds. The uptake of C¹⁴O₂ was inhibited by virtually anaerobic conditions. From the above observations, it is considered likely that C¹⁴ is transformed through the reactions of the tricarboxylic acid cycle. C¹⁴ in the soluble fraction was markedly increased by maintaining the root material in water rather than in a nutrient solution prior to exposure to C¹⁴O₂. This increase was chiefly in malic acid. (auth)

763

Atomic Energy Project, Univ. of Rochester
THE METABOLISM OF GLUTARIC ACID-1,5-C¹⁴: I. IN NORMAL AND PHLORIZINIZED RATS, by Morton Rothstein and Leon L. Miller. Oct. 22, 1952. 16p. (UR-223)

Glutaric acid-1,5- C^{14} fed to normal and phlorizinized rats is rapidly metabolized, 50% of the dose being found in expired CO_2 within 7 hours. Isotopic carbon was found in carbons 3 and 4 of isolated glucose, and in the carboxyl carbon of acetoacetate and acetate. The position and concentration of the C^{14} suggests that glutarate is probably metabolized by decarboxylation to butyrate followed by conversion to acetate. However, oxidation of glutarate to acetone dicarboxylate, followed by decarboxylation of the latter to acetoacetate is another pathway which cannot be excluded. (auth)

64

DETERMINATION OF THE COURSE OF REVASCULARIZATION OF SKIN TRANSPLANTS BY RADIOACTIVITY MEASUREMENTS WITH A SCINTILLATION COUNTER. Lieselott Herforth and Peter Schäfer. *Arch. expl. Path. Pharmacol.* 216, 317-22(1952). (In German)

Revascularization in autotransplants of rat skin were studied by injecting uranyl acetate solution into the transplant bed and measuring the α -activity increase in the transplant and in the adjacent normal skin with a scintillation counter. Diffusion into the transplant was slow, the activity with respect to that of the injection site being 18% after 48 hr and 128% after 6 days, with no further change at 60 days. (G.Y.)

65

AN APPLICATION OF NATURAL C^{14} ACTIVITY IN FOOD-STUFF CHEMISTRY. V. Faltings. *Angew. Chem.* 64, 605-6(1952) Nov. 21. (In German)

It is possible to distinguish between organic substances containing fossil carbon and those containing biological carbon by means of differences in their C^{14} activity. Alcohol and vinegar samples have been investigated as examples. Changes in the mixing ratio of the isotopes in the course of alcoholic fermentation could be proved. (auth)

66

CHANGES IN THYROID ACTIVITY AT LOW ATMOSPHERIC PRESSURES AND AT HIGH ALTITUDES, AS TESTED WITH I^{131} . F. Verzar, E. Sailer, and V. Vidovic. *J. Endocrinol. and Metab.* 8, 308-20(1952) Oct.

The activity of the thyroid gland of rats was observed by measuring the uptake of I^{131} in the living animal over a period of several days. The method is described in detail, and the importance of iodine contained in the diet or applied to the skin, in affecting the results, is stressed. Reduction of the atmospheric pressure to 250 and 380 mm Hg decreases the uptake of I^{131} . The lower the pressure, the less iodine is concentrated in the thyroid. Under natural conditions a small decrease of thyroid activity at an altitude of 3450 m (490 mm Hg) can be noticed, but not at 2010 m altitude (592 mm Hg). The depression of the thyroid is temporary; after some days I^{131} is taken up again with normal velocity. At low atmospheric pressure (below 480 mm Hg) the body temperature decreases, but this, too, is restored to normal in 3 to 4 days. The adaptation of thyroid activity to low atmospheric (oxygen) pressure may play an important part during acclimatization to high altitudes. The mechanism underlying the alteration in thyroid function and, in particular, the relation between the thyroid and adrenocortical activity is discussed. It is suggested that the increased adrenocortical activity and the decrease of thyroid activity observed at low oxygen or atmospheric pressure may be inter-connected. (auth)

67

A STUDY OF THE NATURE OF THE CIRCULATING THYROID HORMONE IN EUTHYROID AND HYPERTHYROID SUBJECTS BY USE OF PAPER ELECTROPHORESIS. William P. Deiss, Edwin C. Albright, and Frank C. Larson. *J. Clin. Invest.* 31, 1000-5(1952) Nov.

The sera of three euthyroid and three hyperthyroid subjects have been studied using I^{131} as a tracer isotope and

paper electrophoresis for separating the major plasma protein components. After twenty-four hours the radioactivity localized in two major zones, one in the slowest moving albumin and the other in a zone of low protein concentration just ahead of alpha-2 globulin. This localization was seen in both euthyroid and hyperthyroid subjects. Soon after administration of I^{131} most of the radioactivity was associated with the albumin fraction but in the hyperthyroid individual there was a rapid shift to the alpha region. A similar though considerably slower shift occurred in the euthyroid subjects. Present evidence indicates that the hormonal iodine is carried by the alpha globulin fraction. The tracer iodine concentrated faster, attained higher levels, and declined more rapidly at this site in the hyperthyroid than in the euthyroid subjects. (auth)

768

THE ACTION OF THYROTROPIC HORMONE AND CORTISONE ON THE UPTAKE OF I^{131} BY THE THYROID GLAND. F. Verzar and V. Vidovic. *J. Endocrinol. and Metab.* 8, 321-8(1952) Oct.

Hypophysectomized rats were injected with 25 μ c of I^{131} , and the I uptake of the thyroid was followed with a Geiger counter for several days. At post-hypophysectomy intervals of 18 to 59 days no I^{131} was concentrated in the thyroid. An anterior pituitary extract ('Preglandol,' Hoffmann-La Roche) in daily doses of 0.2 ml given for 2 or 3 days, restored the activity of the thyroid. Thyrotrophin (Armour), a highly purified preparation, in quantities of 1 to 10 mg/day also restored the thyroid activity after 2 to 3 days. One or two daily injections of 2.5 mg cortisone, administered simultaneously with Preglandol or thyrotrophin, prevented this activation of the thyroid. It is concluded that the effect of cortisone is due to a direct inhibition of the thyroid, and not to interference with the production of thyrotrophic hormone. (auth)

769

ASSAY OF MIXED RADIOISOTOPES. J. F. Tait and E. S. Williams. *Nucleonics* 10, No. 12, 47-51(1952) Dec.

Treatment is given the technique of assaying when two or more different tracers are used simultaneously in biological systems. The particular example given is for the assay of Na^{24} and K^{42} mixtures, but the methods and techniques are of general application. 28 references. (L.M.T.)

770

AN AUTORADIOGRAPHIC STUDY OF IODINE DISTRIBUTION IN LARVAE AND METAMORPHOSING SPECIMENTS OF ANURA. James Norman Dent and Ernest L. Hunt. *J. Exptl. Zool.* 121, 79-97(1952) Oct.

Numerous larvae of *Hyla versicolor* and a few of *Rana palustris* and *Bufo americanus* at representative stages of metamorphic development were immersed in solutions containing 1, 3, 5, or 20 μ c/ml of radioiodine for periods of 24 hours and were fixed after various periods of time following removal from the radioactive solutions. Measurements of relative radioactivities were made and contact autoradiograms were prepared from sections of these larvae. The radioiodine was found to be taken up by the larvae, apparently in amounts directly proportional to its concentration in the solution. Autoradiograms revealed a wide dispersion of iodine in tissues other than the brain, spinal cord, and skeleton. When animals were fixed one day after removal from radioiodine solutions, marked localizations of iodine were consistently apparent in the thyroid (of the intact animal), the gut, pigmented tissues (particularly the pigmented layer of the eye), the thymus, and the horny teeth. As the period of time between removal from radioiodine solution and fixation was increased radioactivity in the gut, horny teeth, and subdermal chromatophores diminished but continued to be marked in the pigmented layer of the eye, the thymus, and the thyroid. This pattern of localization showed no clear-cut

tendency to vary with stage of metamorphic development, iodine dosage, or species. Neither was the pattern altered by thyroidectomy. Thyroid and thymus glands of animals exposed to higher (5 and 20 $\mu\text{C}/\text{ml}$) concentrations of I^{131} were frequently destroyed or extensively damaged but radiation damage to those organs was not apparent earlier than 17 days after exposure to 1 $\mu\text{C}/\text{ml}$. Iodine was released from thyroid tissue which had suffered extensive radiation damage but was retained by thymus glands showing almost complete destruction. It is suggested that the iodine localized in pigmented tissues has been united with thyrosine at those sites of localization. 44 references. (auth)

771

PREPARATION OF TISSUES FOR IODINE-131 COUNTING. Jesse D. Perkinson, Jr. and H. D. Bruner. *Nucleonics* 10, No. 11, 66-7 (1952) Nov.

The inhomogeneity of I distribution in tissues is demonstrated. A tissue-digestion technique that is the basis for accurate determinations of activity range with the Marinelli method for counting liquid samples is described. The technique consists essentially of mincing and mixing the tissues, treating with a reagent (2N NaOH with 0.1 ml of 0.5M NaI and 0.1 ml of 0.5M NaHSO_4 was the best of these studied), incubating overnight at 70°C, and counting the activities by the Marinelli method. (L.T.W.)

772

A TEST OF TRITIUM AS A LABELING DEVICE IN A BIOLOGICAL STUDY. Walter G. Verly, Julian R. Rachele, Vincent du Vigneaud, Maxwell L. Eidinoff, and Joseph E. Knoll. *J. Am. Chem. Soc.* 74, 5941-3 (1952) Dec. 5.

These experiments demonstrate that an isotopic selection takes place in the over-all direction of the greater retention of the carbon-tritium bond in the utilization of the methyl group of methanol in the biosynthesis of the labile methyl group. A mixture of methanols containing C^{14} , D, and T has been administered to rats, and the isotopic contents of the methyl groups of the choline and creatine isolated from the tissues have been compared with those of the methyl group of the methanol administered. The ratio of deuterium to C^{14} in the choline methyl was 22% of that in the methanol, whereas the ratio of T to C^{14} in the choline methyl was 60 to 75% of that in the methanol. Hence one might arrive at quite different interpretations of the possible biological pathways of methanol depending on whether T or D was used as the labeling device. (auth)

CHEMISTRY

773

Radiation Lab., Univ. of Calif., Berkeley
THE PERMANGANATE OXIDATION OF URACIL AND 5-NITROURACIL, by J. L. Fairley, L. L. Daus, and B. Krueckel. Nov. 11, 1952. 5p. (UCRL-2003)

Permanganate oxidation of uracil-4- C^{14} and 5-nitro-uracil-4- C^{14} indicates that in the two compounds ring cleavage occurs both between carbons 4 and 5 and carbons 5 and 6. (auth)

774

THE DISTRIBUTION OF THE SUBGROUP VII ELEMENTS BETWEEN PYRIDINE AND 4N NaOH. W. Goishi and W. F. Libby. *J. Am. Chem. Soc.* 74, 6109 (1952) Dec. 5.

Interest in the isolation of Tc activities from meson-irradiated Ag led to determination of the distribution coefficients of heptavalent Re, Tc, and Mn between pyridine and

4N NaOH. The results show that all these elements are extractable into pyridine from strongly alkaline aqueous solution. (G.Y.)

775

PREPARATION OF RADIOHYPOPHOSPHATE ION. Thera Moeller and Gladys H. Quinty. *J. Am. Chem. Soc.* 74, 6123 (1952) Dec. 5.

In conjunction with investigations on the hypophosphates Th and the rare earth elements, hypophosphate ion (P_2O_6) containing P^{32} was required. This was best prepared as the disodium dihydrogen salt by the direct oxidation of elemental radiophosphorus with Na chlorite by an adaptation of the procedure of Leininger and Chulski (*J. Am. Chem. Soc.* 71, 2385 (1949)). Attempted preparations involving exchange of inactive hypophosphate with radioorthophosphate and with radiopyrophosphate gave negative results in keeping with other observations on the general absence of exchange among the oxidation states of P. (G.Y.)

776

RADIOMETRIC DETERMINATION OF THE SOLUBILITIES OF THORIUM AND CERTAIN RARE EARTH METAL HYPHOSPHATES. Thera Moeller and Gladys H. Quinty. *J. Am. Chem. Soc.* 74, 6123 (1952) Dec. 5.

Solubilities of ThP_2O_6 , $\text{Nd}_4(\text{P}_2\text{O}_6)_3$, and $\text{Y}_4(\text{P}_2\text{O}_6)_3$ in aqueous HCl solutions, as determined with a P^{32} tracer technique, are tabulated. The data indicate that ThP_2O_6 remains essentially quantitatively insoluble in <4N HCl, whereas the rare-earth hypophosphates are sufficiently soluble to permit separation. ThP_2O_6 is markedly less soluble than ThP_2O_7 . (G.Y.)

777

REPLY TO THE REMARKS OF P. W. SCHENK ON OUR WORK: HALOGENIDES OF DI- AND TRIVALENT THORIUM. E. Hayek. *Monatsh.* 83, 1210-12 (1952) Oct. 15. (In German) (cf. NSA 5-6647, 7-71)

The position of Th, Pa, and U in the periodic table is discussed further. (G.Y.)

ANALYTICAL PROCEDURES

778

Sloan-Kettering Inst. for Cancer Research
STUDIES ON THE STRUCTURE OF NUCLEIC ACIDS. VI. THE KINETICS OF DESOXYRIBONUCLEASE ACTION, by Liebe F. Cavalieri and Barbara Hatch. [nd] 17p. (AECU-2323)

The kinetics of desoxyribonuclease action have been investigated by measuring the liberation of hydrogen ions. This was accomplished by observing the decrease in extinction of the p-nitrophenol-phenolate buffer system used. A plot of initial rate vs. initial substrate concentration exhibits a maximum which is attributed to inhibition by substrate. Since the order of reaction with respect to time is greater than that with respect to concentration, inhibition of the products of reaction is indicated. This was demonstrated to be the case experimentally. Since the inhibition by products is pronounced, it is suggested that the first products of reaction are nucleic acid-like in nature, rather than small entities. An analysis is set forth which suggests that both the inhibition by substrate and that by products involves the doubly charged phosphate anion though structural features must also be considered. (auth)

779

Engineering Research Inst., Univ. of Mich.
SPECTROCHEMICAL ANALYSIS OF TITANIUM METAL AND ALLOYS; INTERIM REPORT NO. 2, by J. H. Enns, Sept. 1952. 23p. (NP-4178; Interim Report No. 2; U2497)

A porous-cup solution technique was developed for the quantitative spectrochemical analysis of Ti metal and alloys.

In the absence of available standards. Analytical curves based on synthetic standard solutions were prepared; unknown solutions analyzed from the curves became known standards for the direct analysis of other unknowns. The over-all procedure is limited by 2 factors: (1) the necessity for chemical similarity between the standard and unknown and (2) the nonhomogeneous nature of the Ti metals. The standards were made by the Peterson method (*Anal. Chem.* **22**, 1398(1950)) with TiO_2 , Ti metal, and $\text{K}_2\text{TiO}(\text{C}_2\text{O}_4)_2$ as the Ti sources. The test specimens had nominal 1.3% Fe-2.7% Cr and 5% Fe-10% Cr compositions. Low-inductance ST-3 parameters were employed. Analytical-gap parameters were maintained as a 4-mm spacing with the lower C cup shaped to a 130° included angle. Samples were exposed for 20 sec. Results obtained from the oxide standards agreed with those from a chemical analysis but were consistently higher (about 10%) than those from the metal and oxalate standards. The metal and oxalate solutions gave similar Fe contents, but the presence of a Cr impurity in the oxalate was indicated. The method had an adequate sensitivity down to 0.05% and perhaps to 0.01% Fe and Cr. (TID-LC)

70

Department of Mines and Technical Surveys (Canada)
A RATEMETER ASSAY UNIT, by H. R. Hardy. Oct. 14, 1952. 38p. (NP-4232; TR-103/52)

A rapid method of radiometric assaying of uranium-bearing ore is described. The unit built consists of a liquid-phosphor scintillation detector and ratemeter counter. To reduce stray radiation heavy lead shielding was required; details are given on this problem. The ratemeter circuit is described in some detail and performance figures are given. Calibration curves are shown, along with a discussion of filling and density factors. (auth)

31

DETECTION AND DETERMINATION OF CARBON IN STEEL BY USE OF ARTIFICIAL RADIOACTIVITY. Irène Curie. *J. phys. radium* **13**, 497-8(1952) Nov. (In French)

When steel samples are irradiated with deuterons (6.7-Mev in the present report), the Fe produces only long-lived radioactivities of weak intensities, whereas the C is strongly activated in producing 10-min N^{13} . This permits determination of C in the steel and investigation of its distribution by autoradiography. (tr-auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

71

Carbide and Carbon Chemicals Co. (K-25)
THE CRYSTAL STRUCTURE OF METHYL CHLORIDE AT -125°C , by R. D. Burbank. Issued Dec. 3, 1952. 12p. (K-980)

The crystal structure of methyl chloride has been investigated by x-ray diffraction at -125°C . The arrangement of the molecules is equivalent to that in the chlorine structure if the methyl groups are replaced by chlorine atoms. The chlorine-carbon bond distance is 1.80 Å. Several possible orientations of the methyl group have been considered and an orientation in which the intermolecular chlorine-hydrogen distances are all 3 Å or more is in best agreement with the x-ray data. (auth)

81

AN X-RAY POWDER STUDY OF β -URANIUM. J. Thewlis. *Acta Cryst.* **5**, 790-4(1952) Nov. 10.

Measurements of the line intensities of powder photographs of β -uranium and a 1.4 at. % Cr-U alloy at 720°C show differences that suggest that further refinement of the structure should be carried out on β -uranium itself and not on the alloy. The measurements show, too, that such a

refinement is indeed necessary, the reliability index of the approximate structure proposed by Tucker being about 30%. In the course of the work the Debye characteristic temperature of β -uranium and the linear coefficients of thermal expansion of β -uranium (assumed to be the same as those of the alloy) and of UO_2 have been found. The various data given in the paper are as follows: β -Uranium, $a = 10.759 \pm 0.001$, $c = 5.656 \pm 0.001$ Å, density = 18.11 g/cm^3 , Debye characteristic temperature = 270°K (all at 720°C). Linear coefficients of thermal expansion from 20 to $720^\circ\text{C} = 23 \times 10^{-6}/^\circ\text{C}$ along the a axis, $4.6 \times 10^{-6}/^\circ\text{C}$ along the c axis. U-Cr alloy, $a = 10.590 \pm 0.001$, $c = 5.634 \pm 0.001$ Å, density = 18.56 g/cm^3 (all at room temperature). $a = 10.763 \pm 0.005$, $c = 5.652 \pm 0.005$ Å, density = 17.93 g/cm^3 (all at 720°C). UO_2 , linear coefficient of thermal expansion at 20 to $720^\circ\text{C} = 11.5 \times 10^{-6}/^\circ\text{C}$. (auth)

FLUORINE AND FLUORINE COMPOUNDS

784

Carbide and Carbon Chemicals Co. (K-25)
NON-IDEALITY OF URANIUM HEXAFLUORIDE VAPOR: PART I, by R. D. Ackley and PART II, by D. W. Magnuson. Issued Dec. 28, 1951. Decl. Dec. 2, 1952. 9p. (AECD-3475; K-840)

The equation of state $P(1 + AP)V = nRT$, where A is a function of temperature but not of pressure, was assumed for uranium hexafluoride vapor up to a pressure of one atmosphere, and moderately accurate values of A for two temperatures were determined by a method based on P-V-T measurements. These values were 0.032 atm.^{-1} at 60°C . and 0.021 atm.^{-1} at 94°C (standard deviations were 0.003 and 0.002 atm.^{-1} , respectively). In order to confirm these results, A was determined at 61.1°C by utilizing a microwave dielectric constant technique. The more precise value obtained, with its probable error, was $0.0330 \pm 0.0007 \text{ atm.}^{-1}$. (auth)

785

Minnesota Mining and Manufacturing Co.
SYNTHETIC RUBBERS FROM CARBON-FLUORINE COMPOUNDS, by A. M. Borders. Aug. 1952. 113p. (WADC-TR-52-197(pt.2))

Exploratory studies of the preparation and properties of fluorine-containing polymers are described. These syntheses and tests are directed to highly solvent-resistant elastomers with the widest possible useful temperature range. New classes of materials include polymers of unsaturated and perfluoroalkyl esters, fluorine-containing alkoxyalkyl acrylates, and vinyl 1,1-dihydroperfluoroalkyl ethers, and copolymers of perfluoroacrylonitrile, and of perfluorobutadiene. Polymers and copolymers of 1,1-dihydroperfluoroalkyl acrylates continue to exhibit the best balance of low temperature flexibility and resistance to aromatic hydrocarbon fluids. Improved curing systems and reinforcement studies of these rubbery acrylate polymers have permitted comparison with commercially available synthetic rubbers. These compounds have adequate mechanical properties for gasket performance and have exceptional resistance to swelling by many fuels and fluids of interest to the Air Force. Although reinforcement of the fluoroacrylate homopolymers has not been possible, their butadiene copolymers have been reinforced to vulcanizates with tensile strengths in excess of 2000 psi. (auth)

786

DISSOCIATION ENERGY OF FLUORINE BY AN EXPLOSION METHOD. E. Wicke and H. Friz. *Naturwissenschaften* **39**, 522(1952) Nov. (In German)

$\text{F}_2\text{-H}_2$ mixtures, with or without addition of other gases

(HF, A), were detonated in a steel pressure vessel. Measurements of peak pressures gave the value 37.0 ± 2 kcal/mole for the dissociation energy D_0 of F_2 . Similar experiments with Cl_2 - F_2 explosions and previous knowledge of dissociation energies and heats of formation of ClF and Cl_2 gave $D_0(F_2) = 37.2 \pm 1$ kcal/mole, in good agreement with the first value. (G.Y.)

787

FLUORINE-CONTAINING POLYMERS. I. COPOLYMERS OF PERFLUORO-OLEFINS. R. M. Adams and F. A. Bovey. *J. Polymer Sci.* **9**, 481-92(1952) Dec.

The authors have studied the copolymerization behavior of perfluoropropene, perfluorobutene-1, perfluorobutene-2, perfluoroisobutene, perfluoropentene-1, and perfluorononene-1. They have so far not succeeded in homopolymerizing these olefins. However, certain nonfluorinated, nonconjugated comonomers—ethylene, vinyl chloride, vinyl acetate, and the vinyl alkyl ethers—were found to copolymerize readily, giving copolymers containing up to 50 mole %, and in some cases slightly more than this, of the perfluoro-olefin in the copolymer. The higher members of the series copolymerize in general less readily than the lower members. The products ranged from viscous oils to tough, film-forming solids. The difficulty of homopolymerization and the relative ease of copolymerization of the perfluoro-olefins with the above comonomers are discussed and interpreted in terms of probable electron distributions around the double bond. (auth)

788

ORGANIC FLUORIDES. PART XIII. THE HIGH-TEMPERATURE DIMERISATION OF CHLOROTRIFLUOROETHYLENE. M. W. Buxton, D. W. Ingram, F. Smith, M. Stacey, and J. C. Tatlow. *J. Chem. Soc.*, 3830-4(1952) Oct.

Chlorotrifluoroethylene, when passed through a tube packed with Pyrex glass chips at about 700°C , is converted into a complex mixture of products, the chief of which is 1,2-dichlorohexafluorocyclobutane. This product is formed also when the olefin is heated at 200°C under high pressures. By dechlorination, the cyclic dimer is converted into perfluorocyclobutene; this gives the corresponding 1,2-dibromo compound with bromine, and, by oxidation with aqueous permanganate, tetrafluorosuccinic acid. (auth)

MOLECULAR STRUCTURE

789

Institute for Atomic Research, Iowa State Coll.
ELECTRON DEFICIENT COMPOUNDS. VII. THE STRUCTURE OF THE TRIMETHYLALUMINUM DIMER, by Paul H. Lewis and R. E. Rundle. Oct. 1952. 30p. (ISC-270)

The trimethylaluminum dimer has a bridge structure with a skeletal symmetry of D_{2h} within the accuracy of a structure determination by x-ray diffraction of single crystals. Bridge bonds, Al-C, equal 2.24 Å, vs. Al-C bonds of 1.99 Å for the exterior, "normal" methyls. The bridge angle, Al-C-Al = 70° , the exterior angle C-Al-C = 124° . It is shown that a simple model provides the right order of magnitude for the heat of dimerization, and indicates the relative importance of Al-C and Al-Al bonds. It is suggested that the sharp bridge angle required for good bridge bonding leads to metal-metal repulsions which should increase as the size of the metal increases. This probably plays a role in the instability and nature of polymers of the heavier trialkylmetal compounds. (auth)

790

AN ELECTRON DIFFRACTION INVESTIGATION OF THE MOLECULAR STRUCTURES OF KETENE, CARBONYL FLUORIDE AND TETRAFLUOROETHYLENE. T. Taylor Broun and R. L. Livingston. *J. Am. Chem. Soc.* **74**, 6084-91(1952) Dec. 5.

The interatomic distances in ketene, carbonyl fluoride, and tetrafluoroethylene have been determined by electron diffraction, using the visual correlation procedure. The following results were obtained: ketene, $C=C = 1.30 \pm 0.02$ Å, $C=O = 1.16 \pm 0.02$ Å with $\angle HCH$ and $C-H$ assumed to be $117.5 \pm 12.5^\circ$ and 1.07 ± 0.02 Å, respectively; carbonyl fluoride, $C=F = 1.32 \pm 0.02$ Å, $C=O = 1.17 \pm 0.02$ Å and $\angle FCF = 112.5 \pm 6^\circ$; tetrafluoroethylene, $C-F = 1.30 \pm 0.02$ Å, $C=C = 1.33 \pm 0.06$ Å and $\angle FCF = 114 \pm 3^\circ$. The results for ketene are compared with an earlier electron-diffraction investigation and with infrared and microwave results. The interatomic distances in C_2F_4 compare favorably with those obtained in a recent electron diffraction investigation in which the rotating sector was employed. (auth)

RADIATION EFFECTS

791

CONTROL OF THE CHEMICAL ACTION OF THE BEAM DURING ELECTRON-DIFFRACTION EXPOSURES; CASE OF COBALT CHLORIDE HYDRATE. René Lecuir and Mme René Lecuir. *Compt. rend.* **235**, 946-8(1952) Oct. 27. (In French)

Destruction of the sample during electron-diffraction exposures led the authors to measure directly the absorption of beam energy. The precision of the measurements was sufficient to permit following the details of decomposition of the sample. Changes in the diffraction pattern of $CoCl_2 \cdot 2H_2O$ are illustrated. (tr-auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

792

SOLUBILITY OF CERIUM(IV) PYROPHOSPHATE. J. C. Brantley and J. R. Huizenga. *J. Am. Chem. Soc.* **74**, 6101(1952) Dec. 5.

The solubility of CeP_2O_7 in H_2O has been found, by a p^{32} tracer technique, to be 0.00007 ± 0.00005 g/liter. In aqueous H_2SO_4 solutions the following solubilities were found: $0.114N$, 0.026 ± 0.005 ; $0.228N$, 0.046 ± 0.005 ; $0.342N$, 0.073 ± 0.005 ; and $0.684N$, 0.207 ± 0.10 g/liter. CeP_2O_7 has a greater solubility in H_2SO_4 than the analogous ThP_2O_7 has in HCl solutions of similar normalities and should be about twice as soluble in HCl as in H_2SO_4 of the same normality. (G.Y.)

SEPARATION PROCEDURES

793

Radiation Lab., Univ. of Calif., Berkeley
THE SEPARATION AND CHARACTERIZATION OF PHOSPHORYLATED COMPOUNDS FROM GREEN PLANTS (thesis), by Murray Goodman, Sept. 29, 1952. (UCRL-1961)

Methods are presented for the separation of phosphates by anion exchange techniques. These techniques have been applied to the separation and characterization of phosphates contained in green algae. The hydrolysis constants are given for a diphosphate which was identified as ribulose diphosphate. The isolation and characterization of a group of highly polymerized phosphates, i.e., metaphosphates is discussed. A brief analysis of the theory of ion exchange is presented together with a correlation of certain results with the theory. (auth)

SYNTHESES

794

Los Alamos Scientific Lab.
CONDENSATIONS OF PRIMARY ALIPHATIC NITRAMINES WITH FORMALDEHYDE, by Leon Goodman. [nd] Decl. with deletions Dec. 22, 1952. 8p. (AECD-3479; LADC-1279)

A convenient condensation of formaldehyde with several

primary nitramines in strong sulfuric acid leading to the formation of N,N' -dialkyl methylene dinitramines has been observed. The reaction is $2RNHNO_2 + CH_2O \rightarrow [RN(NO_2)]_2CH_2 + H_2O$, where R is CH_3 , C_2H_5 , $n-C_4H_9$, or $-CH_2CH_2-$. Thus formaldehyde seems to stabilize the primary nitramines to the sulfuric acid in the same way as it stabilizes nitramide. The yields from the condensation reaction are only fair, probably due to the concurrent decomposition of the nitramines in the strong acid. Since low temperatures (below $0^\circ C$) and very efficient stirring were found to be necessary for good results, 80 to 90% sulfuric acid solutions were used to permit these conditions. Cyclohexyl nitramine failed to react similarly to the other primary nitramines, and it was not found possible to identify any products from the reaction. Nitrourethan also failed to condense with formaldehyde under the chosen experimental conditions. Attempts to employ chloral or paraldehyde in place of formaldehyde were unsuccessful. The use of the Lewis acid, boron trifluoride, as a substitute for the sulfuric acid is noted. (G.Y.)

795

Air Force Radiation Lab., Univ. of Chicago
THE BIOLOGICAL AND MEDICAL ASPECTS OF IONIZING RADIATION: THE INFLUENCE OF NITROGEN MUSTARDS ON CITRIC ACID SYNTHESIS IN VIVO, by Kenneth P. Dubois, Jere Deroin, and Kenneth W. Cochran. Nov. 1952. 5p. (NP-4270; Report No. 1)

The influence of nitrogen mustards on citrate synthesis in rat tissues in vivo was studied using the fluoroacetate technic of Potter. The results of this study demonstrated that nitrogen mustards produce alterations in citrate synthesis in certain tissues which are qualitatively similar to those produced by x-ray. Thus, a decrease in citrate synthesis was observed in spleen and thymus glands of nitrogen mustard-poisoned animals, and a marked increase in citrate accumulation was observed in the livers of male rats. The increase in citrate accumulation in the liver was evident after doses far below the LD_{50} and persisted for several weeks following sublethal doses of the nitrogen mustards. (auth)

796

PREPARATION OF GLYCEROL EVENLY LABELED WITH C^{14} . S. Abraham. *J. Am. Chem. Soc.* **74**, 6098-9(1952) Dec. 5.

Preparation of glycerol with all its carbons uniformly labeled with C^{14} , using uniformly labeled glucose as starting material, is described. (G.Y.)

797

HIGHLY RADIOACTIVE SUGAR. L. Sverak, H. Bilek, and E. Broda. *Montash.* **83**, 1116-24(1952) Oct. 15. (In German)

Biosynthesis of sugar by *Solanum hendersonii* leaves in a $C^{14}O_2$ atmosphere and subsequent extraction of glucose and fructose are described. Specific activities of 63×10^6 and 30×10^6 cpm/mg of glucose and fructose, respectively, were obtained. These are said to be by far the highest activities obtained by any sugar synthesis described in the literature. (G.Y.)

798

4-CHLORO-2-IODOPHENOXYACETIC ACID LABELLED WITH I^{131} . R. L. Jones. *J. Chem. Soc.*, 4080-2(1952) Oct.

A synthesis of I^{131} -labeled 4-chloro-2-iodophenoxyacetic acid was desired in which the I^{131} would be introduced in the last step. The reaction of 4-chloro-2-ohloromercuriphenoxyacetic acid, produced by boiling 4-chlorophenoxyacetic acid in aqueous mercuric acetate, with I_2 in acetic acid proved to be suitable. (G.Y.)

TRACER APPLICATIONS

799

THE PHOTOCHEMICAL DECOMPOSITION OF HYDROGEN PEROXIDE. QUANTUM YIELDS, TRACER AND FRACTIONATION EFFECTS. John P. Hunt and Henry Taube. *J. Am. Chem. Soc.* **74**, 5999-6002(1952) Dec. 5.

The quantum yield of the photochemical decomposition of H_2O_2 at relatively high light intensity is independent of the concentration of H_2O_2 , of acidity, and of the presence in the solution of Br^- , Cl^- , NH_4^+ , or Mn^{++} . At $25^\circ C$, the limiting quantum yield at λ 2537 Å is 0.98 ± 0.05 and at $0^\circ C$ it is 0.76 ± 0.05 . The primary efficiencies are taken as $\frac{1}{2}$ of the limiting quantum yields. Tracer experiments show that the O_2 formed in the photodecomposition originates entirely in the H_2O_2 . The exchange between O_2 and H_2O_2 during the photodecomposition is at most very slight. The fractionation effects associated with the non-chain process for decomposition have been determined. They do not appear to be compatible with hydroxyl radicals as the sole net products of the primary act. (auth)

TRANSURANIC ELEMENTS AND COMPOUNDS

800

THE PARTICIPATION OF f ORBITALS IN BONDING IN URANIUM AND THE TRANSURANIUM ELEMENTS. Robert E. Connick and Z. Z. Hugus, Jr. *J. Am. Chem. Soc.* **74**, 6012-15(1952) Dec. 5.

On the basis of chemical and x-ray evidence it is suggested that f orbitals participate in the metal-oxygen bonding in the oxygenated ions MO_2^{++} and MO_2^+ of the uranides. The electronic structures and the small coordination number are discussed. The bonding in the infinite chains of $\dots U-O-U-O \dots$ in UO_3 is compared with that in uranyl ion. It is shown that the entropy of uranyl ion can be accounted for by a charge distribution of +4 on the U and -1 on each O. The conclusion is drawn that plutonyl ion should hydrolyze less readily than uranyl ion in spite of the actinide contraction. (auth)

URANIUM AND URANIUM COMPOUNDS

801

Carbide and Carbon Chemicals Co. (K-25)
LIQUID-VAPOR EQUILIBRIUM IN THE SYSTEM URANIUM HEXAFLUORIDE-HYDROGEN FLUORIDE, by R. L. Jarry, F. D. Rosen, C. F. Hale, and W. Davis, Jr. Issued Mar. 10, 1952. Decl. with deletions Dec. 29, 1952. 40p. (AECD-3483; K-872)

Liquid-vapor equilibrium in the system UF_6 -HF has been determined over the whole range of compositions and from 40 to $105^\circ C$. In this temperature range, and considerably beyond, the system is one of maximum pressure at constant temperature. Vapor-liquid separation factors, heats of vaporization, and activity coefficients have been calculated with respect to a formula weight of HF of 20.00. This procedure is convenient and practical but is not in agreement with calculated molecular weights of HF vapor, in contact with solutions, which vary from 60 to 100 over the temperature range 40 to $60^\circ C$. (auth)

ENGINEERING

802

Langley Aeronautical Lab., NACA
THERMAL BUCKLING OF PLATES, by Myron L. Gossard, Paul Seide, and William M. Roberts. Aug. 1952. 39p. (NACA-TN-2771)

An approximate method, based on large-deflection plate theory, for calculating the deflections of flat or initially imperfect plates subject to thermal buckling is outlined. The method is used to determine the deflections of a simply supported panel subjected to a tentlike temperature distribution over the plate surface. Experimental results for a particular panel are in good agreement with the theoretical results considered in the test. (auth)

803

VACUUM SEALING IRRADIATION CONTAINERS BY COLD WELDING. P. B. Aitken. *Nucleonics* 10, No. 11, 89-90(1952) Nov.

The parts to be joined are degreased, the oxide layer removed, and the parts squeezed together to reduce the thickness by about one-half, when welding takes place. The method works well with commercial Al and Cu, and particularly well with very pure Al. Test capsules sealed by cold welding normally withstand 500 lb/in² internal pressure before bursting. (L.T.W.)

HEAT TRANSFER AND FLUID FLOW

804

Carbide and Carbon Chemicals Co. (K-25)
LAMINAR FLOW IN CHANNELS WITH POROUS WALLS, by Abraham S. Berman. Issued Nov. 28, 1952. 40p. (K-944)

This investigation was undertaken to further the understanding of mass and momentum transfer as these phenomena occur in a fluid flowing in porous-walled channels. The scope has been limited to two-dimensional, incompressible, steady state, laminar flow. The hydrodynamics of the flow has been treated in detail to give specific information concerning the effect of porous walls on velocity components and pressure drops. This information was obtained by an exact solution of the Navier-Stokes flow equations under the flow conditions mentioned above with the additional condition of uniform suction at the porous walls. The case of a channel of rectangular cross section having two porous bounding walls of equal permeability is presented in detail. The solutions for other cases of interest are presented in an abridged fashion. These include a channel of rectangular cross section with one solid and one porous wall, or two porous walls of different permeability; and a porous tube of circular cross section. (auth)

805

Illinois Inst. of Tech.
AXISYMMETRIC FLOW OF AN IDEAL INCOMPRESSIBLE FLUID ABOUT A SOLID TORUS, by E. Sternberg and M. A. Sadowsky. Aug. 1, 1952. 30p. (NP-4192)

This paper contains an exact solution in series form to the problem presented by the irrotational, axisymmetric flow of an ideal, incompressible fluid past a solid torus of circular cross section. At infinity the fluid is assumed to be in a state of uniform motion parallel to the axis of the torus. The solution is based on the use of toroidal coordinates, and is given in terms of Legendre functions of fractional order as well as complete and incomplete elliptic integrals of the first and second kind. The individual component solutions employed are interpreted physically through their relation to the basic ring singularities represented by the source ring and the vortex ring. The problem is first approached via Stokes' stream function exclusively and is subsequently resolved independently in terms of the velocity potential alone. The convergence of the pertinent series developments is found to be unusually favorable, and a complete stream line pattern, corresponding to an illustrative numerical example, is included. (auth)

806

Massachusetts Inst. of Tech.
BOILING HEAT TRANSFER PROJECT MONTHLY PROGRESS REPORT, by George Henry, Milton W. Raymond, and Joseph B. Walsh. Nov. 1, 1952. 6p. (NP-4218)

In order to determine the effect of vapor volume on average density of the total mass above the heater strip a relation for the ratio of the average density to liquid density was derived. (L.T.W.)

807

Massachusetts Inst. of Tech.
BOILING HEAT TRANSFER PROJECT; MONTHLY PROGRESS REPORT, by George Henry, Milton W. Raymond, Joseph B. Walsh, and Peter Griffith. Dec. 1, 1952. 26p. (NP-4230)

Visual-density data in liquids are reported for a bubble velocity of 10 fps at pressures from 500 to 1500 psia and temperatures from 345 to 562°F. Results indicate that increases in heat flux bring about similar increases in vapor volume which in turn produce greater effects on the mixture density. (L.T.W.)

808

Columbia Univ.
BOILING AND CONDENSING OF LIQUID METALS, by C. F. Bonilla. Oct. 24, 1952. 6p. (NYO-3150)

Condensation data for Hg vapor on vertical low-C steel and 304 stainless steel tubes have been obtained at pressures from 2.3 to 15 lbs/in.². Drop-wise condensation was always obtained. The film coefficient of heat transfer ranged from 700 to 1800 Btu/hr × ft² × °F, much lower than expected. Traces of inert gas may cause this effect, which is being studied further. A horizontal plate apparatus for the boiling of Na has been designed and is under construction. (L.T.W.)

809

Office of Air Research
HEAT PROPAGATION PAST AND FUTURE, by D. G. Samaras. Mar. 1951. 80p. (OAR-TR-8; ATI 167314)

General heat propagation through solids and fluids, heat propagation attended by phase changes, and radiation are reviewed, a mathematical-physics approach being used. Starting with the general equations, a discussion is given pertaining to the meaning of the terms in the equations, and the types of general solutions and boundary conditions involved are examined. The discussion then is extended to cover the most recent developments in certain important fields such as turbulence and molecular physics, which it is felt will have a pronounced influence in the development of a basic theory of heat propagation. The author hopes to create interest in and to indicate certain starting points for research in heat propagation. 96 references. (G.Y.)

810

Oak Ridge National Lab.
FORCED CONVECTION HEAT TRANSFER IN PIPES WITH VOLUME HEAT SOURCES WITHIN THE FLUIDS, by H. F. Poppendiek and L. D. Palmer. Issued Dec. 17, 1952. 39p. (ORNL-1395)

This paper is concerned with forced convection heat transfer in long, smooth pipes whose flowing fluids contain uniform volume heat sources; also, heat is transferred uniformly to or from the fluids at the pipe walls. Dimensionless differences between the pipe wall temperature and the mixed-mean fluid temperature are evaluated in terms of several dimensionless moduli. These analyses pertain to liquid metals as well as to ordinary fluids. (auth)

MATERIALS TESTING

811

Battelle Memorial Inst.

THE PERFORMANCE OF WATER-LUBRICATED SLEEVE BEARINGS, by R. W. Dayton, C. M. Allen, and H. A. Van Dyke. Dec. 2, 1952. 34p. (BMI-786)

The performance of water-lubricated bearings, made of a wide variety of materials, has been investigated. The results indicate that the best performance is obtained with very hard materials: ceramic bearings and sintered carbide journals. The methods of testing, description of equipment, selection of materials, and results of tests on a variety of materials are presented. (auth)

PUMPS

812

Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro (Brazil)

METHODS OF OBTAINING HIGH VACUUM BY IONIZATION. CONSTRUCTION OF AN "ELECTRONIC PUMP," by Helmut Schwarz. Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro (Brazil) and Brasil Univ., Rio de Janeiro (Brazil). Sept. 1952. 9p. (NP-4223; Physics Note No. 5)

Calculations on the possibility of obtaining high vacuum in an electrical discharge are given. It is shown that in a simple d-c gas discharge practically no real pumping action is possible; in such a discharge only clean-up, i.e., electrical adsorption, may be observed. A real pumping action only results if it is possible to get within a tube such a high ion current by special arrangements that the number of ionized gas molecules transported with this current in one direction is greater than the number of gas molecules that will diffuse back in the opposite direction. An electronic high-vacuum pump of real pumping action has been built; it starts pumping at about 10^{-3} mm Hg and gives an ultimate pressure lower than 5×10^{-6} mm Hg. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

813

North American Aviation, Inc.

THE CORROSION OF REFRACTORY MATERIALS IN SODIUM, by R. L. Loftness, W. C. Ruebsamen, and T. A. Coultas. Issued Nov. 20, 1951. Decl. with deletions Dec. 1, 1952. 41p. (AECD-3472; NAA-SR-126)

The corrosion of refractory materials in liquid sodium and sodium vapor at 900°C for periods of time up to 1 month was studied under static conditions. Vacuum-distilled sodium was used in all but a few instances. Changes in weight, appearance, and metallographic structure were observed, and post-run chemical analyses of the sodium were made. In general the rates of corrosion were higher in liquid sodium than in sodium vapor. The presence of excessive oxygen in the sodium increased the corrosion rates. In order of decreasing resistance to corrosion by sodium at 900°C the materials are: molybdenum, tungsten, Haynes Stellite-25 (Co, Cr, W, Ni alloy), type 347 stainless steel, Kennametal-138A (TiC + Co), tantalum, and titanium. Graphite, copper, platinum, spinel, alumina, magnesite, and zirconia showed poor resistance. Silicon carbide, molybdenum silicide, and thoria showed good resistance to corro-

sion. Synthetic sapphire and single-crystal magnesite had good resistance. Experimental procedures and equipment are described. Analytical methods for the presence of the following substances in sodium are described: oxygen, potassium, calcium, magnesium, silicon, aluminum, nickel, niobium, chromium, iron, molybdenum, tantalum, titanium, tungsten, zirconium, carbon, and sodium carbide (evidenced by acetylene formation). (auth)

814

Knolls Atomic Power Lab.

CERAMIC WHEEL SPHERE GRINDER, by Peter Senio and Charles W. Tucker, Jr. [nd] 3p. (AECU-2324)

A device for making spherical boron carbide single crystals is described. A $\frac{3}{8}$ -in. hole drilled through to the 3-in. central cavity of a commercial grinding wheel allowed a tangential jet of air to impel the crystals along the cylindrical track. Spheres of boron carbide were produced in $\frac{1}{2}$ hr with an air pressure of 60 psi. Tests indicate that with proper selection of hardness, grit size, and other variables the abrasive wheel can be used to make spheres of both hard and soft materials. (C.R.)

GEOLOGY AND MINERALOGY

815

Geological Survey

DOMESTIC PHOSPHATE DEPOSITS, by V. E. McKelvey, J. B. Cathcart, Z. S. Altschuler, R. W. Swanson, and Katherine Lutz. Nov. 1952. 49p., 3 illus. (TEI-271)

Most of the world's phosphate deposits can be grouped into six types: igneous apatite deposits, marine phosphorites, residual phosphorites, river pebble deposits, phosphatized rock, and guano. The igneous apatites and marine phosphorites form deposits measurable in millions or billions of tons; the residual deposits are measurable in thousands or millions; and the other types generally only in thousands of tons. Igneous apatite deposits have been mined on a small scale in New York, New Jersey, and Virginia. Marine phosphorites have been mined in Montana, Idaho, Utah, Wyoming, Arkansas, Tennessee, North Carolina, South Carolina, Georgia, and Florida. Residual phosphorites have been mined in Tennessee, Pennsylvania, and Florida. River pebble has been produced in South Carolina and Florida; phosphatized rock in Tennessee and Florida; and guano in New Mexico and Texas. Present production is limited almost entirely to Florida, Tennessee, Montana, Idaho, and Wyoming. Incomplete but recently partly revised estimates indicate the presence of about 10 billion tons of phosphate deposits in the United States that is minable under present economic conditions. Deposits too lean in quality or thickness to compete with those in the western and south-eastern fields probably contain tens of billions of tons. (auth)

816

CONVERSION OF ZIRCON INTO THE METAMICT STATE.

K. K. Zhurov. *Doklady Akad. Nauk S.S.S.R.* 85, 889-91 (1952) Aug. 1. (In Russian)

817

ISOTOPIC COMPOSITION OF LEAD AND THE AGE OF THE EARTH. A. P. Vinogradov, I. K. Zadorozhnyi, and S. I. Zykov. *Doklady Akad. Nauk S.S.S.R.* 85, 1107-10 (1952) Aug. 11. (In Russian)

The isotopic compositions of Pb in 32 samples of galena collected about the globe were measured mass-spectrographically. The ages of the samples ranged from 25×10^6 to 1600×10^6 yr. The minimum and maximum ages of the earth's crust are found to be 2.1×10^9 and $5.0 \pm 0.5 \times 10^9$ yr, respectively. (G.Y.)

818

PROBABILITY OF THE EXISTENCE OF RADIOACTIVE MINERALS IN CERTAIN REGIONS OF FRENCH MOROCCO.

Léon Puzenat. *Compt. rend.* 235, 1234-6(1952) Nov. 17. (In French)

The present note has for purpose the demonstration of those factors in favor of the presence of radioactive minerals in certain regions of French Morocco which have the same geologic, tectonic, and metallogenic characteristics as other regions of the globe where U deposits exist. (tr-auth)

819

STUDY OF RADIOACTIVE MINERALS BY COMBINED ELECTRON-REFLECTION RADIOGRAPHY AND AUTORADIOGRAPHY. Jean-Jacques Trillat and Léa Tertian. *Compt. rend.* 235, 1123-5(1952) Nov. 10. (In French)

Combination of the method of electron radiography (emission of secondary electrons under the influence of hard x rays) and autoradiography permits determination of the distribution of the elements of different atomic number on the surface of a polished sample of radioactive mineral and their correlation with the zones of radioactivity. (tr-auth)

820

MECHANISM OF HELIUM DIFFUSION IN ZIRCONS. Paul Pellas. *Compt. rend.* 235, 1134-6(1952) Nov. 10. (In French)

In a recent article, Hurley (NSA 6-3570), studying zircons and spheles with the purpose of determining their geologic age by a modification of the He method, attributed the damage observed in the crystal structure of zircon to the ionization produced by α particles. As the present calculations show, this ionization also permits rapid diffusion of He atoms in the disturbed crystal lattice. (tr-auth)

METALS AND METALLURGY

821

Oak Ridge National Lab.

BORAL: A NEW THERMAL NEUTRON SHIELD, SUPPLEMENT I, by A. S. Kitzes and W. Q. Hullings. Issued July 3, 1951. Decl. Dec. 4, 1952. 18p. (AEC-D-3476; ORNL-981)

822

Institute of Engineering Research, Univ. of Calif., Berkeley
TECHNICAL PROGRESS REPORT [ON] CREEP OF ALLOYS RESEARCH [FOR] JULY 1 TO DECEMBER 1, 1952, by E. R. Parker and T. H. Hazlett. Dec. 1, 1952. 5p. (AECU-2330)

The effects of Co and Fe on the plastic properties of Ni are being investigated to determine the role played by d-shell electrons on the bonding and plastic properties of transition elements. Results thus far indicate that the addition of Co to Ni up to 9 at.% has but slight effect on the tensile properties and creep resistance, but additions of similar quantities of Fe give marked increases in the tensile properties and creep resistance. No definite conclusions have been drawn concerning the role of the d-level electrons. Results obtained on four series of solid solution Ni alloys were reported in AEC report COO-64. Creep tests of pure Ni indicate that the parameter A varies exponentially with the reciprocal of the absolute temp. for temperatures $>550^{\circ}\text{C}$. (L.M.T.)

823

Atomic Energy Research Establishment, Harwell, Berks (England)

A CRITICAL REVIEW OF THE ALLOYING BEHAVIOUR OF ZIRCONIUM, by P. C. L. Pfeil. June 9, 1952. 26p. (AERE-M/TN-11)

This review has been made to assist in a discussion of the alloying factors operating in zirconium-based systems.

Since comparatively few constitutional diagrams have been published, it has been necessary to make use of microstructural work intended for a different purpose. Of the metallic elements, intermediate phases are formed with Cu, Ag, Au, Be, Al, Ga, Si, Ge, Sn, V, Cr, Mo, W, Mn, Fe, Co, Ni, Ru, Os, Ir, and Pt. There is evidence for appreciable solid solubility in either alpha, beta, or both modifications of zirconium of the following metallic elements: Cu, Ag, Al, Sn, Ti, Hf, Th, U, Nb, Ta, Cr, Mo, W, Mn, Fe and Co. Zirconium and titanium appear to form continuous series of solid solutions in both the alpha and beta modifications. There is no published evidence to establish that any metallic element increases the alpha \rightleftharpoons beta transition temperature of zirconium. Evidence exists that Ti, Th, U, Nb, Ta, Cr, Mo and Fe depress the transition temperature while there are indications that W, Cu, Mn and Co may do the same. So far as can be judged from the indirect evidence available, molybdenum and tungsten depress the transition more rapidly than niobium and tantalum, which in turn give a more rapid depression than does titanium. The $\beta/(\alpha + \beta)$ phase boundary in zirconium-rich alloys is depressed in temperature more rapidly by thorium than by uranium. The rate of depression given by uranium is probably similar to that given by titanium. (auth)

824

Massachusetts Inst. of Tech.

STUDIES AND EXPERIMENTAL INVESTIGATIONS FOR THE DEVELOPMENT OF PHASE DIAGRAMS OF THE TITANIUM-CHROMIUM AND TITANIUM-COPPER ALLOY SYSTEMS: PART 2. THE TITANIUM-COPPER AND THE TITANIUM-CHROMIUM PHASE DIAGRAMS, by Arnold S. Joulkainen and Frank B. Cuff. Dec. 1951. 41p. (AF-TR-6595(pt.2))

In view of the recognition of the potentialities of titanium and its alloys as important structural materials, there has arisen a need for a systematic investigation of various binary diagrams. Of these, the titanium-copper and the titanium-chromium systems were investigated. The titanium-copper system was found to contain four intermetallic compounds: Ti_2Cu , TiCu , Ti_3Cu_2 and TiCu_3 . It is an eutectoid-type system offering heat treatment possibilities due to a suppression of the alpha-to-beta transformation. The titanium-chromium system was of particular interest because of the improved properties imparted to titanium by small chromium additions. It was found that a continuous series of solid solutions existed between titanium and chromium. An intermetallic compound, TiCr_2 , which decomposes upon heating, was found at 60 to 65 weight percent chromium. At the titanium end of the diagram there is an eutectoid type of reaction at 15 weight percent chromium. (auth)

825

Aeroprojects, Inc.

ULTRASONICS APPLIED TO SOLIDIFICATION AND SOLID-STATE TRANSFORMATION, by J. Byron Jones. Oct. 1951. 80p. (AF-TR-6675)

Ultrasonic energy was applied to 24S and 75S aluminum alloys after solution heat treatment, and the effect on age hardening evaluated, primarily by means of Rockwell hardness readings and tensile tests. The effects were small and indicate that high-intensity elastic energy retards precipitation hardening. Ultrasonic energy was applied to melts of pure magnesium, pure zinc, a 3.5 percent magnesium-zinc alloy, and magnesium-zirconium alloys. Grain refinement was accomplished and sounder ingots resulted from the use of ultrasonics. Zirconium sponge was alloyed with pure magnesium by the application of ultrasonics. (auth)

826

Metallurgical Advisory Committee on Titanium
INFORMATION BULLETIN NO. T4 [ON] EQUILIBRIUM

DIAGRAMS OF TITANIUM ALLOY SYSTEMS. Mar. 1952. 153p. (NP-4165; Information Bulletin No. T4)

Phase diagrams of 23 binary, 22 ternary, and 2 quaternary alloy systems containing Ti are presented with references. (G.Y.)

827

Armour Research Foundation

DEVELOPMENT OF PHASE EQUILIBRIUM DIAGRAMS FOR THE TITANIUM-RICH PORTIONS OF THE TERNARY SYSTEMS Ti-Mn-Al, Ti-Cr-Mo, AND Ti-Mn-Mo; INTERIM TECHNICAL REPORT NO. 3 FOR JUNE 1, 1952-SEPTEMBER 1, 1952. [nd] 29p. (NP-4166; Interim Technical Report No. 3; WAL-401/103-14)

Continuing rechecks on pertinent points in the Ti-Cr-Mo system have confirmed the isothermal sections presented in Interim Report No. 2 (NSA 6-4792). A high-temperature allotropic modification of the phase $TiCr_2$ has been discovered, and its structure has been determined. For the Ti-Mn-Mo system a final β parametric surface has been constructed, and both isothermal and vertical sections of the $\beta/\alpha+\beta$ boundaries have been constructed for temperatures between 550 and 900°C. In the binary system Ti-Mn, the intermediate phase $TiMn_2$ has been positively identified. Another phase of lower Mn content has been recognized as generating from a solid-state reaction. Its identity has not been fully determined. These points are in conflict with the diagram as constructed elsewhere and must be settled satisfactorily before the ternary system can be constructed. For the system Ti-Mn-Al, tentative isothermal sections have been constructed for the temperature levels 1300, 1200, 1100, and 1000°C. Partial isothermal sections are established for the 950, 900, 850, 800, 750, 700, and 650°C temperature levels, and selected vertical sections for alloy ranges of commercial interest have been constructed. (auth)

828

New York Univ.

TITANIUM-RICH TERNARY ALLOYS OF TITANIUM WITH CARBON AND NITROGEN, CARBON AND OXYGEN, AND NITROGEN AND OXYGEN; INTERIM TECHNICAL REPORT NO. 1, by L. Stone and H. Margolin. May 15, 1952. 24p. (NP-4179; Interim Technical Report No. 1; WAL-401/85-10; U24993)

Isothermal sections were constructed for the Ti-C-N and Ti-C-O systems containing 0.1 to 0.5% C and 0.5 to 2.5% N or O between 800 and 1400°C and for 2 Ti-N-O alloy series containing 1% N and equal amounts of N and O up to 2.5% between 900 and 1400°C. The Ti-C-N and Ti-C-O systems exhibited the same phase fields with identical positions relative to each other. In the presence of C, O appeared a better α stabilizer than N; α Ti containing O was more effective in dissolving C than the N-bearing α . In the Ti-N-O system, the effects of N and O were not additive in stabilizing the α phase. Vertical sections for the Ti-N-O ternary showed a considerably expanded $\alpha + \beta$ field. The course of the $\alpha + \beta/\alpha$ phase surface could not be explained entirely by geometric considerations. (TID-LC)

829

Institute of Engineering Research, Univ. of Calif., Berkeley
EFFECT OF PRESTRAIN HISTORIES ON THE CREEP AND TENSILE PROPERTIES OF ALUMINUM; TWENTY-FIRST TECHNICAL REPORT, by Oleg D. Sherby, Alfred Goldberg, and John E. Dorn. Oct. 1, 1952. 32p. (NP-4186)

Creep and tensile data were correlated with the various substructures developed during the testing of annealed and prestrained pure aluminum. The results showed that the nature of the correlations were strongly dependent on the initial state of the metal. Furthermore, the correlations

that were obtained were found to be in contradiction to the known grain-size effects on the creep and tensile properties of metals. Evidence is presented for the attainment of an equilibrium structure and strength developed during creep straining, dependent only on the creep stress. A theory is proposed which attempts to explain the experimental results. (auth)

830

Illinois Inst. of Tech.

PROGRESS REPORT NO. 1 [ON] THE EFFECT OF DISSOLVED ELEMENTS ON THE RATE OF ISOTHERMAL GRAIN GROWTH IN METALS. Oct. 15, 1952. 15p. (NP-4187; Progress Report No. 1)

The rate of isothermal grain growth in pure Fe has been studied preliminary to research on binary solid solutions of such elements as Cr, Ni, Co, Mn, Mo, W, and Si in Fe. A processing procedure that resulted in 98% uniform grain size in the starting material is described, graphs of grain area as a function of time for 600, 800, and 750°C annealing temperatures and 40, 60, and 80% initial cold-reduction from the ingot are plotted, and micrographs illustrating the grain-growth process are presented. 7 figures. (G.Y.)

831

Illinois Univ.

STRUCTURAL CHANGES IN INGOT IRON CAUSED BY PLASTIC AND REPEATED STRESSING, by W. J. Love. Nov. 1952. 76p. (NP-4227; Technical Report No. 33)

Fatigue specimens of Armco Magnetic Iron were prestrained to various levels of tensile or compressive stress, electropolished, and then subjected to repeated bending stresses. At exponentially increasing numbers of stress cycles, half of the specimens were examined by employing the light microscope, electromicrographs and x-ray diffraction patterns of the individual grain reflections. In all cases the fatigue life of ingot iron was increased by the predeformation which induced cold work. Changing the predeformation stress from tension to compression was not found to be significant. The increase of fatigue life with respect to the input prestrain energy was more pronounced when the fatigue tests were conducted at the lower of two stress levels. The initial structural change in both static and fatigue tests was by slip that first occurred in grains whose orientation and boundary constraint allowed yielding to take place at a minimum applied stress. The changes in the structure caused by repeated stressing were localized in nature and tended to concentrate in only a portion of the available grains. The slip produced within these grains tended to localize into bands with the minimum spacing of slip lines about 0.05 to 0.1 μ . Very small cracks (2 to 3 μ long) were found to exist as early as 0.1 per cent of the fatigue life. The round-shaped surface inclusions which were observed had little effect on the general structure change which occurred during static deformation or fatigue. (auth)

832

[Massachusetts Inst. of Tech.]

MECHANICAL ANISOTROPY IN SOME DUCTILE METALS, by W. A. Backofen and B. B. Hundy. [nd] 25p. (NP-4231)

Fracturing test-specimens in tension after prestraining in torsion has shown that a fibrous crack-like structure, causing a considerable degree of mechanical anisotropy, exists in 70-30 brass, nickel, Monel metal, and Armco iron. The same program of testing has also revealed the presence of such a structure in high-purity aluminum, but for reasons that are not clear, the tensile behavior of torsionally prestrained commercially pure (2S) aluminum gave no indication of its presence. (auth)

833

Vanderbilt Univ.

SECOND QUARTERLY REPORT [OF] ARMY ORDNANCE RESEARCH PROJECT AT VANDERBILT UNIVERSITY [ON] IRON-VANADIUM-TITANIUM SYSTEM, by W. P. Fishel. Apr. 1, 1952. 16p. (NP-4236)

A series of iron-vanadium-titanium alloys was studied by dilatation methods in order to ascertain the effect on the Ac3 transformation of alloying two gamma-loop-forming elements in varying proportions with iron. A boundary was established between austenitic and ferritic alloys in this three-component system, and it was shown that vanadium and titanium are less than additive in their effect on the Ac3 transformation in iron when added together. The addition of vanadium to the iron-titanium system lowers the amount of titanium required to produce a closed gamma loop as is the case when titanium is added to the iron-vanadium system, but the effect of the first 0.2% of either titanium or vanadium when added to a binary alloy of iron and the other metal is very small. (NP-4238 covers third quarter) (auth)

834

[Vanderbilt Univ.]

FINAL REPORT [ON] BASIC RESEARCH IN THE GAMMA IRON REGION OF THE SYSTEM Fe-Ti-V AND Fe-Ti-V-C COVERING THE PERIOD FROM JUNE 28 TO SEPTEMBER 28, by W. P. Fishel. Sept. 28, 1952. 17p. (NP-4237; Progress Report No. 4)

A series of alloys in the Fe-Ti-V-C system has been prepared. Alpha-to-gamma allotropic transformation temperatures have been determined by dilatometric methods, employing a heating rate of 3°C throughout the transformation. One class has all of the Ti and V united with the C as carbides, and there is some C present as pearlite. The second class has the entire amount of C combined with all of the Ti and part of the V leaving some V alloyed with ferrite. The third class has all of the C combined with part of the Ti, leaving part of the Ti and practically all of the V alloyed with ferrite. From this study it may be concluded that the Ti and V carbides exert very little influence on the transformation temperatures. Only the Ti and V actually alloyed with ferrite are the controlling factors for the α -to- γ transformation. The precipitated carbides are merely neutral bodies so far as the transformations are concerned. (J.E.D.)

835

Vanderbilt Univ.

THIRD QUARTERLY REPORT [OF] ARMY ORDNANCE RESEARCH PROJECT AT VANDERBILT UNIVERSITY [ON] IRON-VANADIUM-TITANIUM SYSTEM. [nd]. 26p. (NP-4238)

A series of iron-titanium-vanadium-carbon alloys have been prepared. The vanadium content varied from 0.53 to 3.99%, the titanium content varied from 0.54 to 1.42%, and the carbon content varied from 0.18 to 1.13%. From the chemical analyses and supporting metallographic and dilatometric data the following was observed: (1) If there was an excess of carbon, over the amount necessary to form the carbides of vanadium and titanium, these elements would be present in steel only as the carbides. Pearlite is always present in these alloys. (2) If there was a deficiency of carbon below that required to combine with all of titanium and vanadium, then titanium would form titanium carbide with the carbon first, and vanadium would combine with the remaining carbon. (3) If there was insufficient carbon to combine with all of the titanium, practically all of the carbon was present as titanium carbide. From this study it was possible to draw the conclusion that titanium in steel has a greater affinity for carbon than has vanadium, and that

practically all of the carbon in the steels having a Ti/C ratio greater than 4 was present as titanium carbide. (NP-4236 covers second quarter) (auth)

836

Rensselaer Polytechnic Inst.

PROGRESS REPORT NO. 1 [ON] ANISOTROPIC DIFFUSION: SELF-DIFFUSION IN ZINC, by H. B. Huntington, G. A. Shirn, and E. S. Wajda. Dec. 1, 1952. 23p. (NYO-893; Progress Report No. 1)

The solution of the diffusion equation $c/t = D^2c/x^2$ for thin-film boundary conditions with no blocking or evaporation from the surface is $c(x,t) = C_0(Dt)^{-1/2} \exp(-x^2/4Dt)$, where C_0 is the total activity deposited on surface, x is penetration distance into the crystal, t is time for diffusion anneal, D is the diffusion coefficient, and c is concentration of tracer Zn⁶⁵. If $\ln c$ is plotted against the square of the average penetration distance, and a straight line is drawn through the resulting points, the line intercept is $\ln(C_0(Dt)^{-1/2})$, while the slope gives $(-4Dt)^{-1}$. The diffusion coefficient is readily calculated from the individual slope for each temperature run. Sample data for perpendicular and parallel diffusion are shown. The measured values for the self-diffusion for two crystallographic orientations in the temperature range from 240 to 410°C are given. (L.T.W.)

837

Massachusetts Inst. of Tech.

TECHNICAL PROGRESS REPORT [ON] THERMODYNAMICS OF METAL SOLUTIONS, SCOPE I, by M. B. Bever, G. Scatchard, and C. Wagner. Nov. 3, 1952. 22p. (NYO-923)

The activity of Cd in liquid Bi-Cd-Sn alloys has been determined with the aid of emf measurements. From these values the integral molar excess free energy and the partial molar excess free energies of all components have been calculated. (auth)

838

SOLUBILITY AND ACTIVITY OF OXYGEN IN IRON AND VANADIUM MELTS. R. A. Karasev, A. Yu. Polyakov, and A. M. Samarin. Doklady Akad. Nauk S.S.S.R. 85, 1313-16 (1952) Aug. 21. (In Russian)

839

CHEMICAL PROPERTIES OF TITANIUM-ALUMINUM ALLOYS. Jean Cueilieron and Claude Pascaud. Compt. rend. 235, 1220-1 (1952) Nov. 17. (In French)

Ti-Al alloys with less than 53% of Ti contain the compound TiAl₃, which it is possible to isolate. Several properties of this compound are given. Alloys containing 53 to 65% of Ti do not contain this intermetallic compound. It is possible, by selective attack on the Al, to extract the Ti in powder form. (tr-auth)

840

TITANIUM CAN BE CASE HARDENED BY NITRIDING.

Edmond J. Silk. Iron Age 170, No. 20, 166-70 (1952) Nov. 13.

A condensed version of report NP-3956 (NSA 6-5565) is presented. (G.Y.)

841

A THERMODYNAMIC STUDY OF LIQUID METALLIC SOLUTIONS. IV. APPROXIMATE THERMODYNAMIC DATA FROM THE PHASE DIAGRAM FOR THE SYSTEMS COPPER-BISMUTH, COPPER-LEAD AND COPPER-THALLIUM. O. J. Kleppa. J. Am. Chem. Soc. 74, 6047-51 (1952) Dec. 5.

For the systems Cu-Bi and Cu-Tl some new data have been presented on the solubility of Cu in the low-melting metal. Some comments have been presented on earlier attempts at obtaining thermodynamic data for liquid metal mixtures from the phase diagram. The methods do not take into

account the entropy deviations frequently found in such mixtures. A new method has been described which, for certain types of phase diagrams, makes it possible to separate the calculated partial molal free energies (along the liquidus) into approximate heat and entropy terms. The method has been applied to the systems Cu-Pb, Cu-Bi, and Cu-Tl. The calculated heat data have been compared with calorimetric data where such data are available. (auth)

842

A THERMODYNAMIC STUDY OF LIQUID METALLIC SOLUTIONS. V. THE SYSTEMS ZINC-BISMUTH AND ZINC-LEAD. O. J. Kleppa. *J. Am. Chem. Soc.* **74**, 6052-6(1952) Dec. 5.

The thermodynamic properties of the liquid systems Zn-Bi and Zn-Pb have been studied by the e.m.f. method. Both systems show a fairly large positive ΔH of mixing, and both systems have positive entropy deviations. The extent of the liquid miscibility gaps has been checked by equilibrium measurements. In the case of the system Zn-Pb the results are in excellent agreement with the most reliable data available in the literature. For the system Zn-Bi the present investigation gives a critical temperature of $\sim 605^\circ\text{C}$ at 85 at. % Zn, while earlier work indicates a critical mixing temperature of about 750 to 800°C . This discrepancy indicates that the earlier procedures did not provide full opportunity for the system to reach equilibrium. (auth)

843

APPLICATION OF FLUORESCENCE X-RAYS TO METALLURGICAL MICRORADIOGRAPHY. H. R. Spletstosser and H. E. Seemann. *J. Applied Phys.* **23**, 1217-22(1952) Nov.

Fluorescence x-rays may be more useful analytically in metallurgical microradiography than the line emission from a tube target because of the greater homogeneity of the former radiation. Although the intensity of fluorescence is very low, exposure times are not prohibitive for some applications. In the present report, the method and apparatus are described and illustrative examples are shown. (auth)

PHYSICS

844

Pennsylvania State Coll. School of Mineral Industries
A STUDY OF THE THERMAL EXPANSION OF GLASSES, by M. D. Karkhanavala. Nov. 1952. 24p. (NP-4229; Technical Report No. 53)

The low-temperature expansion of high-silica (~ 67 mole %) glasses increases with decreasing field strength of the other cations. The volume difference between a chilled and an annealed glass decreases as the silica content is decreased, as large cations are substituted for small cations of the same charge, and as nonnoble gas-type cations replace the noble gas-type cations of similar size and the same charge. The electron configuration of a cation does not appreciably affect the low-temperature expansion of a high-silica glass but has an effect in low-silica glasses. The ratio of the expansivity before and after the critical range is a maximum around 67 to 70 mole % of silica. The thermal expansion is approximately additive for glasses with more than ~ 70 mole % SiO_2 . (auth)

845

Radiation Lab., Univ. of Calif., Berkeley
ANGULAR DISTRIBUTION OF BREMSSTRAHLUNG RADIATION, by Jack W. Rosengren. Nov. 3, 1952. 16p. (UCRL-1999)

A measurement has been made of the angular distribution of the 322-Mev bremsstrahlung radiation from the Berkeley

synchrotron. The bremsstrahlung is produced by bombarding an internal 0.020-in. Pt target. The photons were detected by the beta activity induced in small Cu disks by the $\text{Cu}^{63}(\gamma, n)\text{Cu}^{62}$ reaction. This reaction would be produced mainly by that part of the bremsstrahlung spectrum of energy near 17.5 Mev. The angular spreading (of order of $6 \text{ mc}^2/\text{E}$) is observed to be much greater than the spread (of order mc^2/E) intrinsic in the bremsstrahlung production process. The theory of Schiff attributes this greater spread to the multiple coulomb scattering of the electrons in the target before radiation. The observed angular distributions is compared with some theoretically predicted distributions and found to be considerably narrower. Its full width at half maximum is 9.2 ± 0.6 milliradians. This fact could indicate an over-estimate of electron scattering at 322 Mev, but the narrower distribution is more likely attributable to the special conditions present in a synchrotron. (auth)

846

SOLAR "ENHANCED RADIATION" AND PLASMA OSCILLATIONS. Hari K. Sen. *Phys. Rev.* **88**, 816-22(1952) Nov. 15.

The dispersion relation for a plasma oscillating in a static magnetic field is derived by the Laplace-transform method. The plasma oscillations are found to be unstable in frequency bands around multiples of the gyrofrequency. A numerical application to spot magnetic fields at coronal distances indicates sufficient amplification to make plausible the theory of the origin of solar "enhanced radiation" in plasma oscillations of electrons gyrating round the magnetic field of sunspots. (auth)

847

AN EQUATION FOR THE NUMERICAL VALUE OF SOMMERFELD'S FINE-STRUCTURE CONSTANT. J. Fuchs. *Naturwissenschaften* **39**, 505(1952) Nov. (In German)

Two published values of the fine-structure constant $1/\alpha$ can be represented by the equations $\pi^{\frac{2}{3}}[(\pi^{\frac{3}{2}}/E^{\frac{1}{2}}) - (E^{\frac{1}{2}}/\pi^{\frac{3}{2}})] = 137.0437\dots$ and $\pi^{\frac{2}{3}}[(\pi^{\frac{3}{2}}/E^{\frac{1}{2}}) - (E^{\frac{1}{2}}/\pi^{\frac{3}{2}}) - (E^{\frac{1}{2}}/\pi^{\frac{6}{5}})] = 137.03644\dots$, where $E = 1 + (1/e) + (1/e^2)\dots = 1.581976707$. (G.Y.)

848

ON THE HYDRODYNAMICS OF NON-VISCOUS FLUIDS AND THE THEORY OF HELIUM II. R. Kronig and A. Thellung. *Physica* **18**, 749-61(1952) Oct.

The classical hydrodynamics of nonviscous fluids for the case of irrotational motion and in the absence of external forces is represented in terms of general field theory. The velocity potential and the density appear then as canonically conjugate variables in a rigorous sense. A quantization is carried out along the usual lines, a number of results previously arrived at by Landau and his collaborators thus finding a full justification. In particular, the concept of phonons becomes completely clarified. The energy and pressure of the fluid when thermally excited are discussed in view of applications to He II, use being made of considerations by Richter on sound pressure in liquids. (auth)

849

MOLECULAR THEORY OF THE λ POINT OF LIQUID HELIUM. I. Prigogine and J. Philippot. *Physica* **18**, 729-48(1952) Oct. (In French)

A cell model is applied to liquid helium. The volume of a cell is equal to the mean geometrical volume per molecule. Each cell may accommodate 0, 1, or 2 particles. The same model has been previously applied to classical liquids by Prigogine and Janssens and is a generalization of the well-known Lennard-Jones, and Devonshire model of liquids. This model permits taking into account in a rather crude way the fluctuations which occur in a classical liquid in the neighborhood of the critical point. It is shown that due to the zero-point energy and the corresponding dilatation of the cells,

those fluctuations may occur in liquid He^4 long before the critical point. These fluctuations depend strongly on the statistics of the particles. In the case of He^4 they give rise to a maximum of the specific heat in the neighborhood of 2°K , in the case of the He^3 this effect is smeared out. This model permits taking into account in a rough, but not unreasonable way, both the interactions and the statistics of the particles. (auth)

850

SOME REFLECTIONS ON PHONONS AND ROTONS. H. A. Kramers. *Physica* 18, 653-64(1952) Oct.

Helium II at zero temperature is considered to have no viscosity and no heat conduction. Transport of momentum and energy is assumed to be due to quantized excitations, which are called excitons. These include Landau's phonons and rotons as special cases. Expressions for velocity distribution and group velocity of the excitons, entropy density, fountain effect, and second-sound velocity are derived. A comparison of theory with recent experiments is made. For a tentative picture of what the excitons might be, they are linked to the possible states of an individual He atom inside the box formed by the surrounding atoms, comparable to s , p , d states. The excitons might be propagations of such states through the liquid. (G.Y.)

851

PARAMAGNETIC RESONANCE IN PHOSPHORS. W. D. Hersberger and H. N. Leifer. *Phys. Rev.* 88, 714-20(1952) Nov. 15.

Paramagnetic studies at 9375 Mc have been made on 32 inorganic phosphors containing paramagnetic activators. The sample is contained in a transmission cavity and the spectrum is obtained by a sweeping technique that yields the derivative of the absorption curve. Less than 10^{-11} mole of Mn^{++} may be detected in cubic host crystals. The specimen in the cavity may be illuminated by ultraviolet light for observations on changes in its spectrum under these conditions, but, when illuminated, the changes observed may be attributed largely to photoconduction. The phosphors containing Mn^{++} as an activator under no illumination yield a variety of spectra. Seven of these phosphors display a single absorption line 750 to 1000 gauss wide, while four phosphors with different host crystals but all having cubic symmetry display line spectra consisting of six lines seven gauss wide but with spacings between members of from 68 to 88 gauss depending on the host crystal. Finally, two phosphors display 30-line spectra which arise because the crystal field and the applied field together serve to remove both the I and S degeneracy, whereas for cubic crystals only the I degeneracy is removed. (auth)

852

ELECTRICAL RESISTIVITY OF ARTIFICIAL GRAPHITE. Jun Okada and Tatsuo Ikegawa. *J. Applied Phys.* 23, 1282-3 (1952) Nov.

Specimens of artificial graphite made from 4 parts coal-tar pitch and 10 parts petroleum coke preheated at 500, 1300, 1700 and 2400°C , were heat-treated step by step to higher temperatures, and the electric resistivities measured at room temperature. A graph of the results shows that the lower the preheating temperature of the raw coke employed, the smaller the resistivity of the specimen. This is attributed to the effect of the boundaries between the coke grains and the carbonized pitches. (L.M.T.)

853

THE USE OF RADIOACTIVE MATERIAL FOR THE GENERATION OF HIGH VOLTAGE. E. G. Linder and S. M. Christian. *J. Applied Phys.* 23, 1213-16(1952) Nov.

The directions of particle motion associated with acoustic waves have been computed and are displayed graphically, for

each of the three waves, as a function of propagation direction. The numerical example used is cubic nickel and the maximum polarization angle found is $11\frac{1}{2}$ degrees. (auth)

COSMIC RADIATION

854

SPECTRUM OF FAST PROTONS PRODUCED BY THE NEUTRAL COMPONENT OF COSMIC RADIATION. A. Dadayan and G. Merzon. *Doklady Akad. Nauk S.S.S.R.* 86, 259-62 (1952) Sept. 11. (In Russian)

855

PRODUCTION OF PROTONS BY THE NEUTRAL COMPONENT OF COSMIC RADIATION. A. Khriyan. *Doklady Akad. Nauk S.S.S.R.* 85, 75-8(1952) July 1. (In Russian)

856

INVESTIGATION OF ISOLATED TRACKS PRODUCED IN NUCLEAR EMULSIONS BY COSMIC RADIATION. Hassan Moucharafyeh. *Ann. phys.* (12) 7, 564-603(1952) July-Aug. (In French)

Extensive studies on the nature and origin of the isolated cosmic-ray tracks in nuclear emulsions are reported in this doctoral thesis. It is concluded that these tracks consist, in a small part, of products of nuclear collisions in the immediate neighborhood of the emulsion and, in the major part, of the residue of high-energy protons escaping nuclear collisions. (G.Y.)

857

NATURE OF PENETRATING PARTICLES IN ELECTRON-NUCLEAR SHOWERS. S. A. Azimov, N. G. Birger, V. N. Polynov, and S. A. Slavatskii. *Doklady Akad. Nauk S.S.S.R.* 85, 287-90(1952) July 11. (In Russian)

858

ON THE DECAY OF CHARGED V-PARTICLES. J. P. Astbury, P. Chippindale, D. D. Millar, J. A. Newth, D. I. Page, A. Rytz, and A. B. Sahiar. *Phil. Mag.* (7) 43, 1283-90(1952) Dec.

Among 18,000 photographs taken during an experiment with a large cloud chamber at the Jungfrauoch (3,580 m) 13 examples of the decay of charged V particles have been observed. A summary of the measurements of the 13 particles is given. Two of them are produced in nuclear interactions of remarkably low energy. The average time that the particles would have taken to cross the chamber, if they had not decayed in flight, is $\sim 10^{-8}$ sec, and the distribution of the decay events does not differ significantly from that which would be expected for particles with a mean life greater than 10^{-8} sec. (auth)

859

THE TRANSITION EFFECT FOR COSMIC-RAY BURSTS AT SMALL THICKNESSES OF LEAD. J. R. Prescott. *Proc. Phys. Soc. (London)* A65, 925-9(1952) Nov. 1.

The transition curve for cosmic-ray bursts under lead at sea level is analyzed to find the contributions from stars, extensive showers, electromagnetic interactions of μ mesons, and single high-energy electrons and photons. When this is done, a substantial fraction of the bursts under lead thicknesses less than about 2.5 cm remains unaccounted for. It is suggested that they are produced by "narrow air showers" consisting predominantly of photons of about 2.5×10^8 ev and having a sideways spread of less than 0.3 m. 24 references. (auth)

860

ORIGIN OF COSMIC RAY BURSTS. Geneviève Rochet and Jean Daudin. *Compt. rend.* 235, 1121-3(1952) Nov. 10. (In French)

The barometric effect on cosmic-ray bursts in Pb was determined at Bagnères, France (550 m elevation) and was compared with similar studies on the Pic du Midi (2860 m).

Contributions of the nuclear component and high-energy μ mesons are discussed. (G.Y.)

161

A COUNTER-HODOSCOPE STUDY OF ASSOCIATED PENE-TRATING PARTICLES UNDERGROUND. B. Leontic and A. W. Wolfendale. *Phil. Mag.* (7) **43**, 1335-8(1952) Dec.

A study is reported of the production of pairs of associated penetrating particles examined by means of a counter hodo-scope in a cave under 26 meters water equivalent of rock. (L.M.T.)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

162

Naval Research Lab.

SURFACE STRUCTURE OF QUARTZ CRYSTALS, by George W. Arnold, Jr. Oct. 31, 1952. 16p. (NRL-4065)

As a part of its study of vhf crystals and circuitry above 75 Mc, the Naval Research Laboratory is carrying out an x-ray and electron diffraction study of crystal surfaces and interior regions. The need for such a program stems from the lack of crystal specifications and from the difficulties experienced in manufacturing piezoelectric overtone crystals for use above 75 Mc. The single crystal spectrometer shows rough-ground quartz surfaces to be misoriented up to 8° ; polished surfaces 30 to 45 minutes; etched surfaces from 30 to 60 minutes depending upon etching time. The method is unsatisfactory except as a means of comparison because the results are strictly dependent upon time of exposure to the x-ray beam. The Laue transmission method utilizes the density and width of split Laue spot segments for the comparative determination of degree of misorientation and depth of disorder. For the very thin crystal plates being studied, diffraction spots at wide angles from the primary beam must be used to resolve the separate parts of the spot. This large angle results in an increased path in quartz for the rays scattered from the first surface and makes it difficult to properly correlate density with disorder. Kikuchi line patterns indicate a high degree of crystalline perfection; cross-grating patterns show distortion to be present. Etching experiments on a rough ground crystal show most of the disordered material is removed at a depth of approximately $\frac{1}{20}$ micron. The distortion shown to greater depths by the single crystal spectrometer technique is due to too small a volume of quartz to affect the electron diffraction patterns. (NRL)

ELECTRICAL DISCHARGE

163

MEASUREMENT OF ENERGY OF ELECTRONS AND POSI-TIVE IONS IN PLASMA OF GASEOUS DISCHARGE. N. I. Ionov. *Doklady Akad. Nauk S.S.S.R.* **85**, 753-5(1952) Aug. 1. (In Russian)

164

ELECTRON REMOVAL IN KRYPTON AFTERGLOWS. John M. Richardson. *Phys. Rev.* **88**, 895-900(1952) Nov. 15.

The decay of the electrodeless microwave discharge in samples of Kr at 0.5 to 25 mm Hg was studied by the recently developed techniques of electron-concentration, optical-spectrographic, and optical-photometric measurements as a function of time after termination of the exciting fields out to a maximum of 15 msec. The Kr samples unavoidably contained traces of Xe estimated to be of the order of 0.01 to 0.1 mole percent, and such quantities of Xe were found to enter importantly into the afterglow processes of recombination and radiation in the pressure range 6 to 25 mm Hg. The observations are interpreted in terms of dissociative recombination of the molecular ions Kr_2^+ or $(MXe)^+$ (where M is an undetermined atom, either Kr or Xe) with subsequent

atomic radiation by an excited dissociation product. For Kr, one quantum from various 2p to 1s transitions appears to be associated with each recombination event. Recombination coefficients of approximately 0.6×10^{-6} and 2×10^{-6} cm³/elec-tron-sec are obtained for the Kr and Xe recombination process, respectively. These values do not appear to be pres-suredependent. Results of ambipolar diffusion measurements are also stated. (auth)

165

ABSORPTION IN AN ELECTRON-GAS MIXTURE. Hermann Kober. *Ann. Physik* (6) **11**, 1-11(1952). (In German)

The effect of collision absorption on the polarization of an electron-gas mixture subjected to an alternating electric field is treated by gas theory, and the nonlinear effect of absorption is calculated in the first approximation. (G.Y.)

166

FORMATIVE TIME LAGS OF UNIFORM FIELD BREAK-DOWN IN N₂. G. A. Kachickas and L. H. Fisher. *Phys. Rev.* **88**, 878-83(1952) Nov. 15.

Formative time lags of spark breakdown in N₂ have been measured in uniform fields as a function of percent over-voltage, pressure (150 to 700 mm Hg) and electrode separa-tion (0.3 to 1.4 cm). For the range of variables studied the formative time lags are almost identical with values previ-ously observed in air; the time lags vary from 100 μ sec close to threshold to 1 μ sec at a few percent overvoltage. The present data as well as the earlier measurements in air indicate a secondary mechanism of photoemission of electrons either from the cathode or from the gas near the cathode. This mechanism requires a large number of successive elec-tron crossings. The dependence of the sparking potential on the number of initiating electrons has been determined; the sparking potential of pure N₂ shows an enormous dependence on the value of the primary current. (auth)

867

ELECTROMAGNETIC PROPERTIES OF PLASMAS. Michel Bayet. *J. phys. radium* **13**, 579-86(1952) Nov. (In French)

After examining the hypotheses necessary for establish-ment of theories of plasma, the author studies the conditions for propagation of longitudinal and transverse electromag-netic waves, limiting himself to the case in which magnetic fields do not exist, but taking account of the chance velocity reorientation of the electron caused by collisions. For this purpose, a constant frequency of collision being assumed, he establishes the "mobility equation" relating the electric field to the mean velocity imparted to the electrons and the "dis-persion equations" connecting the wavelength and frequency of the propagated disturbance. (tr-auth)

ELECTRONS

868

QUANTUM THEORY OF THE RADIATING ELECTRON. N. F. Nelipa. *Doklady Akad. Nauk S.S.S.R.* **85**, 1259-62 (1952) Aug. 21. (In Russian)

The calculations of Parzen (NSA 6-933) on the radiation from an electron moving in a uniform magnetic field are criticized. Papers on the same subject have been published by Judd et al. (NSA 6-918) and Olsen and Wergeland (NSA 6-3328). (G.Y.)

869

ON THE THEORY OF THE ELECTRON. III. Walter Wessel. *Z. Naturforsch.* **a7**, 583-93(1952) Sept. (In German)(cf. NSA 5-6267, 5-7147, 5-7148).

The method of difference operators is completely de-veloped by making use of Rosen's model (NSA 5-4636) of the spinning electron, which is shown to be kinematically equivalent to the author's. In order to avoid a reality dif-ficulty in the interpretation of the invariant K, the theory

was modified by exchanging the operators t_k and κ_k . It is shown that an additional magnetic moment of the electron, having the order of magnitude of $1/137$ Bohr magnetons, results from the mass operators suggested by classical considerations. The exact calculation involves mathematical difficulties, principally the infinite matrices in the unmodified equation. Insertion of a finite and not entirely equivalent construction of the commutator algebra yields Dirac's exact equation, but with the additional moment too large by a factor of $16/3$. (tr-auth)

870

ON THE NATURE OF THE MASS AND CHARGE OF THE ELECTRON. H. Salecker. *Z. Naturforsch.* **a7**, 633-4(1952) Sept. (In German)

Consideration of the various mass and charge components of the quantum-electrodynamical electron shows that the total mass and total charge have a purely quantum-electrodynamical origin and do not diverge. (G.Y.)

871

SECONDARY ELECTRON EMISSION OF SEVERAL METALS UNDER THE IMPACT OF POSITIVE LITHIUM IONS. Georges Couchet. *Compt. rend.* **235**, 944-6(1952) Oct. 27. (In French)

An experimental apparatus permitting measurement of secondary electron emission under the impact of $\geq 13,000$ -v positive ions is described. Preliminary results obtained with Li ions on duralumin, 18-8 stainless steel, and mumetal are plotted. (G.Y.)

872

ON THE RENORMALIZATION THEORY OF THE INTERACTION OF ELECTRONS AND PHOTONS. Gyo Takeda. *Progress Theoret. Phys. (Japan)* **7**, 359-66(1952) Apr.

By means of lagrangian transformations the relations among existing renormalization theories of electron-photon interaction are examined. The magnitudes of divergent constants which appear in the calculation of the S matrix are determined, and the total lagrangian which gives the divergence-free S matrix is constructed. By bringing the lagrangian into different forms through transformations of field variables, the equivalence of various formalisms is proved. (L.T.W.)

873

IONIZATION LOSS AND STRAGGLING OF FAST ELECTRONS. E. L. Goldwasser, F. E. Mills, and A. O. Hanson. *Phys. Rev.* **88**, 1137-41(1952) Dec. 1.

The most probable energy loss of 9.6- and 15.7-Mev electrons in samples of about one gram per cm^2 of beryllium, polystyrene, aluminum, copper, and gold has been measured. The losses measured were of the order of one Mev, and the resolution of the apparatus made possible an accuracy of 20 kev. The observed distributions of energy losses are found to be in good agreement with the Landau straggling calculations (*J. Phys. (U.S.S.R.)* **8**, 201(1944)) for the light elements. For the heavier elements there is a spreading of the distribution introduced by radiation and K-electron effects. Calculations made by Yang and Kennedy for gold, including these effects, check well with the experimental data. Applying Fermi's correction for the polarization effect at extreme relativistic velocities to Landau's result for the most probable energy loss, one obtains for the predicted loss in Mev $\Delta_{pe} = 0.1537D(\Sigma Z/\Sigma A) \times [19.43 + \ln(D/\rho)]$, where D is the absorber thickness in g/cm^2 and ρ is the absorber density in g/cm^3 . Experimental results for the light elements are in excellent agreement with this theory. The heavier elements show losses somewhat smaller than those calculated. (auth)

874

INTERPRETATION OF e/m VALUES FOR ELECTRONS IN CRYSTALS. W. Shockley. *Phys. Rev.* **88**, 953(1952) Nov. 15.

This note explains why the recent results of Brown and Barnett (*Phys. Rev.* **87**, 601(1952)) of e/m for electrons in Mo and Zn are consistent with the results that would be expected from the theory of electronic conductivity. (L.M.T.)

875

MICROWAVE SPIN RESONANCE ABSORPTION BY CONDUCTION ELECTRONS IN METALLIC SODIUM. T. W. Griswold, A. F. Kip, and C. Kittel. *Phys. Rev.* **88**, 951-2(1952) Nov. 15.

Conduction electron spin resonance absorption has been observed in fine particles of metallic Na, suspended in paraffin wax, at a frequency of 9240 Mc at room temperature and at 77°K. The particles, ranging in diameter from about 10^{-4} to 10^{-3} cm, were produced by a supersonic technique. The sample containing of the order of 10^{20} Na atoms was placed in a 3-cm wavelength microwave cavity. It was estimated that $\sim 1\%$ of the atoms were in the microwave magnetic field. The spectroscopic splitting factor g was determined as 1.998 to 2.004 and the width of the resonance at half-maximum power was 78 oersteds. Resonance absorption curves are given. (L.M.T.)

CASES

876

Carbide and Carbon Chemicals Co. (K-25)
AN ANALYTICAL METHOD FOR DETERMINING THE TRANSIENT BEHAVIOR OF MULTIPLE SECTION CASCADES, PART I, by J. E. Rowe. Issued Nov. 25, 1952. (K-978)

This report gives an approximate analytical method for determining the transient behavior of multiple section cascades. The method can be applied to transitions induced by changing the feed concentration or flow rates from their steady-state values to new constant values. A discussion which emphasizes the practicality of the numerical procedure is given. (auth)

INSTRUMENTS

877

[Argonne National Lab.]
IMPROVEMENT OF THE RELIABILITY OF THE WILLIAMS MEMORY BY DOUBLE INSPECTION, by Robert W. Schumaker. Sept. 3, 1952. 10p. (AECU-2305; UAC-662)

A variation in the method of writing information into the cathode-ray tubes of the Williams memory system to be used in the ORACLE has been tested with results which indicate that a considerable improvement in signal-to-noise ratio is available. The method is applicable to existing double-dot systems with relatively minor changes, and with no loss in capacity. The information is written as a square array of double dots, exactly similar in structure to the binary digit "1" as usually written in the double-dot system; the meaning of individual digits is determined by the relative positions of the information spot and the re-write spot. The method reduces the effect of refilling of information spots by stray secondary electrons resulting from repetitive consultations of nearby memory locations. (G.Y.)

878

Lewis Flight Propulsion Lab., NACA
AUXILIARY EQUIPMENT AND TECHNIQUES FOR ADAPTING THE CONSTANT-TEMPERATURE HOT-WIRE ANE-

MOMETER TO SPECIFIC PROBLEMS IN AIR-FLOW MEASUREMENTS, by James C. Laurence and L. Gene Landes. Nov. 1952. 77p. (NACA-TN-2843)

The constant-temperature hot-wire anemometer amplifier and accessories have been developed to provide an instrument with wide frequency response, good stability, and ease of operation. Auxiliary equipment has been developed to provide heating currents for large wires, to make average-square computations, and to make double-correlation coefficient measurements. Techniques are described for using this equipment to study periodic phenomena such as surge, rotating stall, and wake surveys in centrifugal- and axial-flow compressors. The application of the equipment to the study of nonperiodic phenomena such as intensity, scale, and spectra of isotropic turbulence is also discussed. Heat-loss data for standardized tungsten wire probes show that no wire calibration is necessary if accuracies of $\pm 5\%$ are sufficient. (auth)

79

Office of Basic Instrumentation, National Bureau of Standards
QUARTERLY PROGRESS REPORT OF THE OFFICE OF
BASIC INSTRUMENTATION FOR THE QUARTER ENDING
JUNE 30, 1952. [nd] 97p. (NBS-1923)

Brief summaries of work are given for the following projects: cathode-ray-oscillograph beam intensification, determination of temperature with the noise thermometer, medical physics instrumentation, anesthesia monitor, electron interferometer, mass spectrometer for study of solids, pulsed photomultiplier, electronic coating-thickness gage, CO₂ hypsometer, absolute measurement of vibration amplitudes, strain and displacement instruments, vacuum-tube accelerometer, ultrasonic velocimeter for liquids, acoustic viscometer for gases, microwave hygrometer, mutual-inductance transducer, application of feed-back around image scanning systems, piezoelectric accelerometer, phase-sampling telemeter, spring transducer, pneumatic instruments based on critical flow, instrumentation for dynamic mechanical measurements, instrumentation utilizing magnetic effects on mechanical vibrations, a calibrated vacuum-leak instrument, humidity measurements by spectroscopic methods, and stability of feed-back systems. (G.Y.)

80

Research Lab. of Electronics, Mass. Inst. of Tech.
QUARTERLY PROGRESS REPORT [FOR PERIOD ENDING
SEPTEMBER 1, 1952], by J. B. Wiesner. Oct. 15, 1952.
71p. (NP-4225)

The following studies are reported: thermionic and electron field emission from W, Zeeman effect and hyperfine splitting of positronium, soft x-ray spectra of Ni, specific heat and thermal conductivity of Mg, Helium II viscosity apparatus, Zeeman splitting and Stark effect for the D₂O molecule, magnetron development, communications research, analog computer research, and the application of transistors in various circuits. (L.M.T.)

81

Baird Associates, Inc.
TECHNICAL REPORT COVERING THE PERIOD SEPTEMBER 1 TO DECEMBER 1, 1952, by Bruce H. Billings, David Z. Robinson, Stanley J. Sage, and John R. Welty. [nd] 18p. (NP-4250)

During the period covered by this report work centered on the application of the mica-spacer Fabry-Perot interferometer to isotopic analyses. A possible instrument for analyzing hydrogen-deuterium mixtures is discussed. This instrument is based upon the fact that the mica spacer can be adjusted to produce two oppositely polarized light beams, one transmitting at $H\alpha$ and the other at $D\alpha$. Experiments have been performed to test the sensitivity and reproducibility of

the system. These preliminary tests indicate that the instrument could be used successfully to measure the relative concentration of two isotopes. (auth)

882

PREPARATION AND STUDY OF SEVERAL THIN HIGH-POLYMER FILMS USED IN NUCLEAR PHYSICS. S. Vuccino. J. phys. radium 13, 543-9(1952) Nov. (In French)

The physicochemical conditions of spreading of polymeric layers on liquids and solids have been studied, in view of using such films as support for radioactive sources and as windows for thin-wall counters. The starting materials were chosen from among those high polymers (polyvinyl chloride, formvar, polystyrene, nylon, and methyl methacrylate) possessing good qualities of mechanical and chemical resistance. These were dissolved in organic solvents free of heavy atoms and suitable for spreading on water and glass. The thin polymolecular films obtained were of the order of $10^{-3} \mu$ on a surface of several square centimeters. The thickness and the homogeneity of the films were studied by interferometry and phase-contrast microscopy. Chemical properties and resistance and ohmic resistance were investigated. (tr-auth)

885

A FAST DIFFERENTIAL PULSE-HEIGHT SELECTOR CIRCUIT. Edward Fairstein and F. M. Porter. Rev. Sci. Instruments 23, 650-1(1952) Nov.

The differential pulse-height selector was designed to replace the integral selectors in amplifiers whose output signal is positive and limited to an amplitude of 120 volts. The circuit consists of an upper or lower gate, a storage circuit, an anticoincidence circuit, and an output stage. Signals are transmitted to the output terminal if their amplitudes fall between the two gate levels. The gate circuits have a minimum dead time of 0.4 μ sec, and the anticoincidence circuit, which doubles as a pulse shaper, has a dead time of 0.8 μ sec. The output stage delivers a 0.7- μ sec, 17-volt pulse of either polarity. The unit can also be used as an integral pulse-height selector. (L.T.W.)

884

COMBINED CURRENT INTEGRATOR AND SENSITIVE MICROAMMETER. H. A. Enge. Rev. Sci. Instruments 23, 599-600(1952) Nov.

A simple current integrator has been designed for use in connection with electrostatic accelerators. It is capable of integrating currents higher than 10^{-8} ampere. A compensation resistor in the input circuit of the integrator is at the same time utilized as a shunt resistor for an electronic microammeter with full-scale readings, 1, 2, and 10 μ a. (auth)

885

FUNDAMENTALS OF GENERAL-PURPOSE REMOTE MANIPULATORS. Raymond C. Goertz. Nucleonics 10, No. 11, 36-42(1952) Nov.

Design criteria to be met in the construction of remote-control manipulators to handle radioactive materials are reviewed. (L.T.W.)

886

REMOTE CONTROL ENGINEERING. H. L. Hull. Nucleonics 10, No. 11, 34-5(1952) Nov.

General principles of remote-control for radioactive materials handling are briefly reviewed. (L.T.W.)

887

ENERGY DEPENDENCE OF SCINTILLATING CRYSTALS. George J. Brucker. Nucleonics 10, No. 11, 72-4(1952) Nov.

The general dependence of light output of various crystals on the energy of the incident radiation is discussed. Experimental curves of crystal response vs. x-ray energy were adjusted to the theoretical curves, and comparison of the re-

sponse of activated and pure crystals showed that the only effect of the activator was to increase the light output by a factor of 10 to 100 with no apparent change in the basic response curves. All the crystals studied were very energy dependent. Anthracene proved to be the most suitable crystal. Its response curve is flat from 150 kev upwards, but shows a faster dropping off at low energies than is predicted by theory. Absorption coefficients of various crystalline elements and compounds are shown. (L.T.W.)

888

A FORCE-REFLECTING POSITIONAL SERVOMECHANISM. Raymond C. Goertz and Frank Bevilacqua. *Nucleonics* 10, No. 11, 43-5(1952) Nov.

Master-slave type manipulators not requiring mechanical connections between the control handle and the mechanical arm need an electrically connected bilateral drive system. The system must reproduce position from input to output and reflect the output load back to the input. The system must be completely reversible and have relatively low effective inertia and friction. Design of a servo system to meet these requirements is described. (L.T.W.)

ISOTOPES

889

California Research and Development Co.
NEUTRON-DEFICIENT ISOTOPES OF CESIUM AND BARIUM, by M. Lindner and R. N. Osborne. Oct. 28, 1952. 6p. (MTA-2)

Introduction. Fink and Templeton (*J. Am. Chem. Soc.* 72, 2818(1950)) have assigned to mass number 128 a neutron-deficient Ba-Cs chain which decayed with a 2.4-day half life, and had 3.0-Mev positrons associated with the decay. Fink and Wiig (*J. Am. Chem. Soc.* 73, 2365(1951)) showed that the Cs daughter had a half life of about three minutes. However, no decay characteristics other than the half life were reported for the parent Ba nucleus. In the present investigation the work of these authors was extended, and the identity of the nuclide Ba^{127} was established. **Procedure.** A Ba chemical fraction was removed from a Cs nitrate target which had been bombarded with 190-Mev deuterons. Cs daughters were separated from the parent Ba by the addition of chilled absolute alcohol to a previously fumed and chilled perchloric acid solution of the Ba to which Cs carrier had been added. The resultant precipitate of Cs perchlorate was collected in a sintered glass filter, washed with alcohol, and counted. The time interval from separation to counting was less than a minute. **Results and Discussion.** In targets more than several hours old, the only Cs daughter which could thus be separated from Ba was Cs^{128} . In three independent determinations, half-life values of 3.80, 3.75, and 3.80 minutes were obtained. No other activity was detectable when decay was followed through five half lives. The Cs daughter accounted for at least 90% of the activity present in the Ba fraction, as determined on an end-window argon-alcohol-filled counter. This figure does not include the loss of Cs sustained during its chemical separation. Thus, essentially all the activity in the 2.4-day decay is due to Cs^{128} . In addition, the curve for growth of the 3.8-minute Cs in a rapidly purified sample of Ba followed that to be expected for growth of a positron emitter in a parent which contained too small a quantity of particulate radiation to be detected with the end-window counter employed in the experiment. From these two facts it appears that Ba^{128} must decay principally by electron capture, since the equilibrium mixture of the isobars contained the positrons reported by Fink and Templeton (*J. Am. Chem. Soc.* 72, 2818(1950)). K x radiation was also found to be associated with the 3.8-minute Cs daughter as determined on a single-channel scintillation pulse analyzer. If these x rays are due to electron capture rather than conversion of

gamma radiation, it would appear that 25 per cent of the Cs^{128} decayed through electron capture. A barium sample was investigated for gamma radiation on the pulse analyzer but interference due to Compton recoils from the annihilation radiation rendered results inconclusive. Immediately following bombardment, a Ba isotope of 12-minute half life was found whose radiations were not directly characterized. Positron emission is probable since electromagnetic radiation seemed to comprise no more than 5% of the total activity detectable on an end-window counter. By four rapid chemical separations made at ten-minute intervals within an hour after bombardment, a Cs activity was obtained from the Ba whose half life and radiation characteristics agree with those reported for Cs^{127} (Fink, Reynolds, and Templeton, *Phys. Rev.* 77, 614(1950)). Furthermore, the yield of this nuclide diminished roughly by a factor of two in each of the four successive separations. The 12-minute Ba activity is thus Ba^{127} . (Entire report.)

890

THE NEW RADIOACTIVE ISOTOPES VANADIUM 46, MANGANESE 50, COBALT 54. W. M. Martin and S. W. Breckon. *Can. J. Phys.* 30, 643-57(1952) Nov.

Three new positron activities assigned to V^{46} (0.40 sec.; $E_{max} > 6.0$ Mev), Mn^{50} (0.28 sec.; $E_{max} > 6.3$ Mev), and Co^{54} (0.18 sec.; $E_{max} > 7.4$ Mev) have been induced by (p,n) reactions which take place in the McGill cyclotron at thresholds less than 12.5 Mev. The assignments are based on the thresholds and on the approximate ft values of the transitions. After a brief period of bombardment, controlled through the oscillator, the targets are shot back by a pneumatic extractor to a position of minimum magnetic field near the cyclotron where a suitably shielded anthracene counter system sends pulses to the main laboratory. Finally the output of a counting-rate meter is displayed against time on an oscilloscope. This visual display reveals immediately new periods in decays, which are then photographed for later analysis. (auth)

891

METHODOLOGY OF WORKING WITH THE RADIOACTIVE SULFUR ISOTOPE S^{35} . L. v. Erichsen and Rich. Müller. *Angew. Chem.* 580-5(1952) Nov. 7. (In German)

In view of its half life of 88 days and its soft β radiation, the isotope S^{35} is very valuable for numerous investigations in organic, inorganic, and biochemistry. The authors describe in detail its preparation, properties, and possible uses, as well as the way of handling substances containing S^{35} . Calculation of the results of the experiments also is discussed. (auth)

MATHEMATICS

892

[Argonne National Lab.]

THE SELECTION OF TUBES FOR THE WILLIAMS MEMORY by J. C. Chu and R. J. Klein. Sept. 3, 1952. 11p. (AECU-2306; UAC-661)

Testing of design samples of storage tubes intended for the Williams memory system of the ORACLE with a full-raster testing technique is described. (G.Y.)

893

Ballistic Research Labs., Aberdeen Proving Ground
THE ACCURACY OF NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS, by Theodore E. Sterne. Oct. 1952. 11p. (BRL-834)

A method is described by which the random and systematic errors may be approximately predicted of numerical solutions of any systems of ordinary differential equations. The errors arise from the accumulation of rounding-off errors, and from the use of erroneous formulas for performing the numerical integrations. The prediction is based on the

properties of solutions of the system of equations adjoint to the variational equations of the problem, and is applicable to any method of integration. (auth)

894

A GRAPHICAL METHOD FOR INTEGRATION OF SCHROEDINGER EQUATIONS. D. Wiskott. *Z. Physik* **133**, 443-8 (1952). (In German)

MEASURING INSTRUMENTS AND TECHNIQUES

895

Radiation Physics Lab., National Bureau of Standards
METHODS FOR CURRENT MEASUREMENT WITH A VIBRATING REED ELECTROMETER, by Frank H. Day and Frank H. Attix. Dec. 1, 1952. 41p. (NBS-2080)

Measurement of ionization currents by means of the vibrating reed electrometer in the potential drop method and with charge-compensating rate-of-drift methods is described. The analysis of calibration procedure in the corrected-scale method and special procedure for applying the electrometer to the measurement of currents from chambers where field distortion is important are reported. (J.E.D.)

896

Radiation Physics Lab., National Bureau of Standards
CALIBRATION OF GENERAL ELECTRIC GAMMA SURVEY METER OF THE SCINTILLATION PROBE TYPE, by R. A. Elmendorf. Dec. 1, 1952. 6p. (NBS-2086)

The principal components of this instrument, a portable rate-meter device for measuring γ and x radiations of medium to very high intensities, consists mainly of a phosphor, a photomultiplier tube, and a bridge-type d-c amplifier. Data are given for calibration of the instrument using Co^{60} γ radiations and x radiations generated at 150-kv constant potential. Directional-dependence tests were made by moving the instrument so that the Co^{60} gammas were incident on the probe at angles from 0 to 165°. (L.M.T.)

897

Electrona Corp.
SECOND QUARTERLY PROGRESS REPORT [ON] DEVELOPMENT OF RADIACMETER IM-79()/PD COVERING PERIOD MAY 15, 1952 TO AUGUST 15, 1952, by Carl Bosch. [nd] 39p. (NP-4131)

Progress is reported on the following phases of the "indicating instrument" problem: tools and methods for manufacture of various parts, methods for manufacturing and polishing steel bearings, material and technique for assembling the movable system, high-vacuum system, method of balancing, and redesigning to overcome misreadings caused by a magnetic top bearing. A small-size friction generator and a small vacuum capacitor were designed and manufactured. (L.M.T.)

898

De Paul Univ.
SECOND QUARTERLY PROGRESS REPORT [ON] SCINTILLATION TECHNIQUES APPLIED TO ELECTRON ENERGY STUDIES [FOR] 1 JULY 1952-30 SEPTEMBER 1952, by Edwin J. Schillinger, Jr. [nd] 14p. (NP-4206)

Further progress is reported (cf. NSA 6-6413 for preceding work) on the construction and testing of a scintillation counter for detecting low-energy electrons and of an electron acceleration system. (G.Y.)

899

Oak Ridge National Lab.
INSTRUMENT RESEARCH AND DEVELOPMENT
QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JULY 20, 1952. Issued Dec. 9, 1952. 12p. (ORNL-1389)

Progress of the work on instrument research and development is briefly reported. Data are presented for the following projects: crystal diodes, neutron-sensitive scintilla-

tion phosphors, evaluation of commercially available instruments for the measurement of radioactivity in water, differential pulse-height discriminator, alpha monitor for airborne contamination, thermistor temperature recorder-controller, gas meter for measuring low gas-flow rates, variable-beat frequency oscillator, d-c integrator, and parallel-plate ionization chamber. (J.E.D.)

900

Technical Operations, Inc.
QUARTERLY PROGRESS REPORT NO. 1 FOR JUNE 15, 1952 THROUGH SEPTEMBER 30, 1952, by A. R. Pearlman and R. R. Smyth. [nd] 22p. (TOI-52-7; Quarterly Progress Report No. 1)

Progress on the feasibility of utilizing transistors in radiac survey meters with a view toward increasing their reliability and performance with a possible reduction in size, weight, and battery power requirements is reported. The available literature on transistor theory and applications has been surveyed, and a bibliography of pertinent literature is appended. The suitability of transistors as generators of the small amount of a-c power necessary for driving dynamic condenser electrometers and for use in high-voltage rectifier power supplies for operating radiation detectors has been investigated. Circuits for rapid testing of transistor characteristics have been constructed. A theoretical analysis of the operation of dynamic condenser electrometers has been made which seems to indicate the possibility of constructing an all-transistor electrometer for portable radiac instrumentation. 45 references. (G.Y.)

901

Radiation Lab., Univ. of Calif., Berkeley
A CLOUD CHAMBER FOR THE STUDY OF PARTICLES OF LOW ENERGY, by T. C. Merkle and J. L. Need. Nov. 6, 1952. 12p. (UCRL-1995)

A cloud chamber with a magnetic selection favoring low-energy particles is discussed. Technical aspects of shielding, expansion, mechanism, sweeping field, and poisoning troubles are included. Discussion of the present mode of operation for a study of π^- capture in helium is given. (auth)

902

A SIMPLE ACTIVATION FOR BeCu MULTIPLIERS. F. J. Fitz Osborne. *Can. J. Phys.* **30**, 658-9(1952) Nov.

A consideration of previous methods used in activating BeCu electron-multiplier plates has resulted in the development of a simple inert gas treatment using a minimum of apparatus and resulting in a total multiplication factor comparable to that obtained by other treatments. (auth)

903

PRECISION MEASUREMENTS OF NUCLEAR γ -RAY WAVELENGTHS OF Ir^{192} , Ta^{182} , RaTh , Rn , W^{187} , Cs^{137} , Au^{198} , AND ANNIHILATION RADIATION. David E. Muller, Harry C. Hoyt, David J. Klein, and Jesse W. M. DuMond. *Phys. Rev.* **88**, 775-93(1952) Nov. 15.

The sensitivity of the curved-crystal gamma-ray spectrometer has been improved by replacing the multicellular Geiger counter formerly used as a detector with a sodium iodide-crystal scintillation counter and by doubling the thickness of the quartz crystal which is used for diffraction of gamma rays. Certain minute nonlinearities in the spectrometer have been detected and corrected in a recent calibration. An analysis of the precision of the instrument based on this calibration and a systematic treatment of errors due to random variations in counting rate is presented. Verification of the quoted precision is achieved by comparisons of wavelengths measured in various orders and by consistency of Ritz combinations. Precision measurements of the wavelengths and energies of nuclear gamma rays and x rays which follow the decay of iridium 192, tantalum 182, radiothorium, radon, tungsten 187, cesium 137, and gold 198, as well as the annihilation radiation from

copper 64, are tabulated. A topological system is used to enumerate all possible level schemes agreeing with a given set of Ritz combinations. This method is applied to determine possible level schemes for iridium 192 and tantalum 182. After all corrections, the measured wavelength of the annihilation radiation from copper 64 agrees, within the precision of the measurements, with the present "best" value of h/mc (for electrons) as obtained by entirely independent methods. It is concluded that to a part in 10^4 there is no evidence for any difference in mass between positive and negative electrons. (auth)

904

HYDROGEN-METHYLAL FILLINGS FOR GEIGER-MUELLER COUNTERS WITH EXTERNAL CATHODES. Daniel Blanc. *J. phys. radium* **13**, 588-9(1952) Nov. (In French)

A Maze-type counter, when filled with H_2 and methylal at 25 and 4 cm Hg pressure, respectively, had a plateau 400 v long and of 3.75%/100 v slope and a threshold of 2000 v. The efficiency changed only slightly with H_2 pressure or temperature (15 to 40°C). Despite the inconvenience of the high threshold, such a counter is suggested as excellent for tritium determination. (G.Y.)

905

DETECTION OF PARTICLES BY SCINTILLATIONS. I. PHOTOMULTIPLIERS. Daniel Blanc, Jean-François Detoeuf, and Paul Maignan. *J. phys. radium* **13**, 567-72 (1952) Nov. (In French).

The principal properties of photomultipliers are reviewed, and mention is made of the measurement of their characteristics and imperfections. Accuracy of the usual commercial apparatuses is discussed. Characteristics of photosensitive G-M counters are compared with those of photomultipliers. Theoretical and statistical calculations will be given in a future article. The electronic circuits are not discussed. 40 references. (tr-auth)

906

DETECTION OF PARTICLES BY SCINTILLATIONS. II. SCINTILLATORS. Jean-François Detoeuf, Daniel Blanc, and Paul Maignan. *J. phys. radium* **13**, 573-8(1952) Nov. (In French)

Properties of the principal organic and inorganic scintillation crystals actually in use are reviewed. Applications of scintillation counters to the detection of various radiations are then considered. 86 references. (G.Y.)

907

GEIGER COUNTER TUBES. N. B. Balaam. *Electronic Eng.* 558-61(1952) Dec.

A review is given of the applications, operating characteristics, and classification of typical Geiger tubes. 18 references. (L.M.T.)

908

LONG MAGNETIC LENS BETA-RAY SPECTROMETERS. PART I. THEORY. PART II. DESIGN AND CONSTRUCTION. J. Sci. Ind. Research (India) **2**, 397-407(1952) Oct.

In Part I, the motion of electrons in axially symmetric magnetic fields is dealt with and new expressions for obtaining the "determinants" of the traces of trajectories of electrons in an axially symmetrical field are derived. The application of these expressions for designing long-lens beta-ray spectrometers, their design features and constructional details, and the performance of some specific designs are described in Part II. The use of shaped "aberration free" magnetic fields for improving the performance of the instrument is discussed. (auth)

909

DETERMINATION OF SMALL QUANTITIES OF RADON BY A COUNTING METHOD. R. Boulanger. *J. belge radiol.* **35**, 569-77(1952). (In French)

A general description (no figures) of the use of an ionization chamber for measuring 10^{-10} to 10^{-13} c/liter concentrations of Rn is given. The possibilities of using active carbon for determining small amounts of Rn and for purifying air containing Rn are discussed. (G.Y.)

910

RELATION OF FILM CHARACTERISTICS TO X- AND GAMMA-RAY MONITORING. G. M. Corney. *Nucleonics* **10**, No. 11, 84-6(1952) Nov.

In the photographic monitoring of x or γ rays an estimate of the dosage received depends upon a measurement of the photographic density of a processed film. This density depends upon two factors - the variation of sensitivity of the film with the quality of the exposing radiation, and the processing procedure under the control of the operator. These sensitivity and processing considerations are discussed. (L.T.W.)

911

CONTINUOUSLY RECORDING RADIOACTIVE HEMOGLOBINOMETER. Arthur C. Guyton, Robert M. Ritter, and James H. Satterfield. *Rev. Sci. Instruments* **23**, 639-41(1952) Nov.

A radioactive method, employing hemoglobin with incorporated Fe^{59} , for continuously recording hemoglobin concentration in the blood of a living animal is described. This method records hemoglobin concentration independently of oxygenation of the blood and independently of the rate of blood flow through the apparatus. For most purposes five microcuries per kilogram of Fe^{59} gives a satisfactory recording, and this quantity of radioactive iron is at least 50 times less than the maximal safe-handling dose. (auth)

912

PROPORTIONAL COUNTERS IN CORONA REGION. Laura Colli, Ugo Facchini, and Emilio Gatti. *Rev. Sci. Instruments* **23**, 621-3(1952) Nov.

The behavior of cylindrical counters filled with argon of various purities has been studied in the corona discharge zone. In this zone the counters act in a normal proportional manner with regard to the detection of α particles. The amplitude of pulses obtained is found to be independent of applied voltage over an interval of about 1000 volts. The discharge mechanism is briefly discussed. (auth)

913

THERMOCOUPLE TEMPERATURES IN A DIFFUSION CLOUD CHAMBER. H. L. Morrison and G. J. Plain. *Rev. Sci. Instruments* **23**, 607-9(1952) Nov.

The radial and vertical thermocouple temperatures in a cylindrical diffusion cloud chamber have been measured during operation, using copper-constantan thermocouples supported by a light Bakelite framework. Readings were taken at regular time intervals, beginning with the addition of the solid CO_2 , through thermal "equilibrium," and until the chamber had ceased to operate upon the depletion of the refrigerant. The vertical thermocouple temperature gradient in the sensitive volume (the lower one-third of the chamber) was found to be approximately $13^\circ C/cm$. The addition of heat to the top of the chamber had negligible effect on the vertical gradient in the bottom third of the chamber and hence changed the depth of the sensitive volume only slightly. There appeared to be no appreciable horizontal gradient. (auth)

914

EVALUATION OF ALPHA-PARTICLE ABSORPTION BY FILTER PAPER. John S. Alencio and John H. Harley. *Nucleonics* **10**, No. 11, 87(1952) Nov.

Results on absorption of U_3O_8 , UF_4 , and UO_2F_2 by filter paper are tabulated. The loss in efficiency of the counting procedure is apparently due to penetration of the paper by the dust or mist. The penetration of the paper by mist is

more marked than that by the solid U compounds. The relative penetration, an consequent α absorption, decreases as the amount of dust collected on the paper increases. No evidence of self-absorption by the U or inert dusts was found. The use of an over-all correction factor of 30% for absorption is justified for routine counting. (L.T.W.)

915

PERFORMANCE OF LUCITE-BONDED ALPHA-SCINTILLATION SCREENS. J. D. Graves, L. A. Webb, and R. H. Davis. *Nucleonics* 10, No. 12, 68-70(1952) Dec.

A method has been developed for preparing Lucite-bonded scintillation screens which are light-opaque, transparent to ionizing radiation, and of rugged construction. The screens consist of a Lucite window with a phosphor coating molded in one surface under a thin film of aluminum. A considerable number of these screens, ranging in size to 6 in. in diameter, have been used successfully in alpha-scintillation and soft x-ray detection. (auth)

916

GRAPHICAL ANALYSIS OF CLOUD-CHAMBER PHOTOGRAPHS. J. S. Campbell and D. F. Welch. *Nucleonics* 10, No. 12, 62-4(1952) Dec.

Stereoscopic photographs of particle tracks in cloud chambers usually have to be transformed into orthographic drawings before quantitative measurements can be made. A graphical method for transformation is derived and applications of the method to problems encountered in the interpretation of cloud-chamber photographs are illustrated. (auth)

917

DISCHARGE MECHANISM IN ARGON COUNTERS. Laura Colli and Ugo Facchini. *Phys. Rev.* 88, 987-98(1952) Dec. 1.

The multiplication curves and the pulse shapes have been studied in a counter filled with pure argon and argon plus carbon dioxide mixtures at pressures ranging from 150 to 1000 mm Hg. The pulse shapes in argon in the high proportional zone and up to voltages corresponding to the corona threshold are explained by assuming a production in the Townsend avalanche of photons hard enough to extract electrons from the cathode. These photoelectrons are found to be produced during a time T_{f0} of the order of a few μsec when at 150 mm Hg pressure, and during a smaller time when at higher pressures. The analysis of the features of the excited levels of argon suggests the four lower excited levels to be responsible for the photoelectric effect. These photons are produced in collisions leading to destruction of these levels, and are not resonance photons. The T_{f0} values deduced from our measurements are in accordance with those obtained by extrapolating the Molnar values for the first metastable levels at the pressures used. This photoelectric process has been found to be the main one responsible for sustaining corona discharge, which starts at multiplication values of about 200. If carbon dioxide concentrations varying from 10^{-4} to 5×10^{-3} are added to argon, one obtains an increase of N_0 , the threshold multiplication, which is linear versus the carbon dioxide percentage. This fact is readily explained by assuming the quenching of argon excited levels by collisions of the second kind on carbon dioxide molecules. From the experimental results one may deduce a value of the quenching cross section which is about $600 \times 10^{-16} \text{ cm}^2$ in a first approximation. Further studies concern the space-charge effect at the photoelectric process divergence threshold, which allows the formation of a very narrow Geiger zone at carbon dioxide concentrations over 5×10^{-4} . No processes other than the photoelectric one have been found to be efficient in counters filled with argon plus carbon dioxide mixtures up to a concentration of 5×10^{-3} . At higher percentages the photoelectric process is considerably reduced; there has been found to be effective in the discharge

build-up a process by which electrons are released in the gas body. The counter behaves as a regular fast counter. The effect of mercury vapor in the discharge in pure argon is also described; it is accounted for by the well-known Penning process of mercury ionization by collision on excited argon atoms. This process causes the discharge to start at extremely low multiplication values. (cf. NSA 6-658). (auth)

918

DETERMINING NEUTRON FLUXES FROM A PULSATING RADIATOR. Allen Brodsky. *Nucleonics* 10, No. 12, 36-9 (1952) Dec.

An expression is derived for the response of a proton-recoil counting-rate meter, designed to measure neutron flux from a random source, as a function of the average neutron flux from a pulsating source. In particular, the fast-neutron hazard around a 23-Mev betatron is analyzed. The system can be used for estimating betatron-produced neutron fluxes in the range from 10 to 1,000 neutrons/cm²/sec. (L.M.T.)

MESONS

919

Los Alamos Scientific Lab.
NUMERICAL SOLUTION OF A MINIMUM PROBLEM, by E. Fermi. Nov. 19, 1952. 17p. (LA-1492)

A particular non-linear function of six independent variables is minimized, using the Los Alamos electronic computer. The values of the variables at the minimum correspond to the phase shift angles in the scattering of pions by hydrogen. (auth)

920

Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro (Brazil)

GAMMA RADIATION EMITTED IN THE PI-MU DECAY, by G. E. A. Fialho and J. Tiomno. 1952. 5p. (NP-4220; Physics Note No. 1)

The frequency of the radiative process (1) $\pi \rightarrow \mu + \nu^0 + \nu$ in π -meson decay as compared to the nonradiative process (2) $\pi \rightarrow \mu + \nu^0$ is calculated, assuming that the emitted μ meson has spin $\frac{1}{2}$. The π meson is assumed to be described by a pseudoscalar wave operator $\phi(x)$ as shown by recent experiments on production and absorption by nuclei. The calculated value for the ratio (1)/(2) is 1.3×10^{-4} which is in reasonable agreement with the experimental value of $2.8 \pm 1.2 \times 10^{-4}$. (L.M.T.)

921

RADIATION CORRECTIONS TO MESON PRODUCTION BY PHOTONS. H. Lehmann. *Ann. Physik* (6) 11, 25-32(1952). (In German)

The second approximation in the meson-nucleon coupling is calculated for the cross section for production of positive π mesons by interaction of a photon of arbitrary energy with a proton. A charged pseudoscalar meson theory with pseudoscalar coupling is taken, and the effect of the correction on the differential and total reaction cross sections is considered. In the latter case (with $\sigma = \sigma_1 + \sigma_2$) for all energies the correction $\sigma_2 \leq 0.1(g^2/4\pi \hbar c) \sigma_1$. (tr-auth)

922

THE PRODUCTION OF CHARGED PHOTOMESONS FROM DEUTERIUM AND HYDROGEN. I. R. S. White, M. J. Jacobson, and A. G. Schulz. *Phys. Rev.* 88, 836-50(1952) Nov. 15.

Hydrogen and deuterium gases have been bombarded in a gas target at a temperature of 77°K and at a pressure of about 140 atm. by the 318 ± 10 -Mev "spread-out" bremsstrahlung photon beam of the Berkeley electron synchrotron.

The charged π mesons which were produced were collimated at angles of 45, 90, and 135° to the beam direction. The π^+ mesons were detected with trans-stilbene scintillation crystals using $\pi\mu$, $\pi\beta$, and $\pi\mu\beta$ delayed coincidences and π^+ and π^- mesons were detected with Ilford C-2 200-micron nuclear emulsions. The ratios of the numbers of π^- to π^+ mesons produced in deuterium were 0.96 ± 0.10 , 1.09 ± 0.12 , and 1.21 ± 0.17 for the angles of 45, 90, and 135°, respectively. No variation of the ratio with meson energy, outside statistics, was observed. Absolute values for the π^+ meson energy distribution functions from hydrogen and deuterium per "equivalent quantum" have been measured at each of the above production angles. The differential and total cross sections have been obtained by integrating over energy and angle, respectively. The experimental ratios of the deuterium to hydrogen cross sections are in good agreement with the phenomenological theory of Chew and Lewis (Phys. Rev. 84, 779(1951)) when the Hulthén deuteron function with $\beta = 6\alpha$ is used in the initial state, plane waves are used for the nucleons in the final state, and the bremsstrahlung cutoff is taken into account. The statistics of the data are, however, not sufficient to determine the amount of spin interaction. The excitation functions for hydrogen and deuterium and points on the angular-distribution curves in the center-of-mass system have been obtained. An upper limit of 0.08 of the charged π -meson cross section was obtained for μ -meson production from deuterium. (auth)

923

THE ELECTRONIC COMPONENT AT LOW ALTITUDES PRODUCED BY π -MESON DECAY. E. D. Palmatier. Phys. Rev. 88, 761-72(1952) Nov. 15.

The intensity of the electronic component at low altitudes produced by π -meson decay (designated as the E_π component) has been obtained as a function of zenith angle and altitude by subtracting from the experimentally observed soft component those electrons arising from the collision and decay processes of μ mesons (designated as E_μ electrons). Extensive auxiliary studies of the corrections required in such soft-component studies are described, and experimental requirements are stated for a precise telescopic study of the soft component. In particular, it is shown that the usual method of correcting a Geiger-counter telescope for side showers is incorrect, and also that the effect of wall-generated secondaries should be considered. It is shown that the E_π component of energy greater than 30 Mev can be represented as a function of zenith angle θ and atmospheric depth h by the expression, $I(E_\pi, h, \theta) = 0.70 \exp(-h/160 \cos\theta) \text{ cm}^{-2} \text{ sec}^{-1} \text{ sterad}^{-1}$, for $\theta \leq 60^\circ$ and $h \geq 700 \text{ g-cm}^{-2}$. (auth)

924

THE MEAN LIFETIME AND FREQUENCY OF PRODUCTION OF CHARGED V-PARTICLES. K. H. Barker, C. C. Butler, M. G. Sowerby, and C. M. York. Phil. Mag. (7) 43, 1201-9(1952) Nov.

Date for the determination of the mean lifetime of charged V particles are discussed, following the procedure outlined by Wilson and Butler (1952). The tracks of twenty-seven V^+ particles have now been photographed on the Pic-du-Midi (2,867 m) by Armenteros et al. (1952) and by the authors in a circular cloud chamber, 28 cm in diameter. It is shown that, using these data, the chamber is too small for the lifetime to be determined, but a lower limit of $1.0 \times 10^{-10} \text{ sec}$ is obtained. Furthermore, the relation between the frequency of production of energetic V^+ particles in penetrating showers of average energy (10 to 30) bev, and various assumed lifetimes is discussed. Using recent photographic emulsion data on the frequency of particles

of mass about 1,200 m_e in the same type of penetrating shower; an upper limit for the lifetime of 10^{-8} sec is obtained. (auth)

925

SCATTERING OF CHARGE SYMMETRIC PSEUDOSCALAR MESONS BY NUCLEONS. W. W. Wada. Phys. Rev. 88, 1032-6(1952) Dec. 1.

The Pauli theory of extended source interacting with the neutral pseudoscalar field with pseudovector coupling has been extended to the case of the charge-symmetric pseudoscalar field, and has been applied to the problem of the scattering of mesons by the nucleons. The results of our calculation show that the scattering cross sections are strongly dependent upon the energy of the incoming mesons, that the cross section for the scattering of π^+ by protons is larger than that for π^- by factor 2.25 at all kinetic energies up to about 150 Mev, and that within the scattering of π^- by protons the cross section for the scattering involving charge-exchange interaction is larger than that with ordinary interaction by a factor which varies from 2.1 to 1.5 as one goes from zero kinetic energy to 150 Mev. When the coupling constant $(f\mu)^2$ is taken to be about 0.3, the maximum of the theoretical cross section curve coincides with the experimental maximum if one assigns 1.25μ (μ = the reciprocal Compton wavelength of the meson) for the spin and isotopic-spin inertia of the nucleon. The scattering cross-section curves for π^+ and π^- approximately agree with the experimental curves if one assigns a value 1.58 for $|G(K)|$, which appears in the original theory of Pauli. (auth)

NEUTRONS

926

Oak Ridge National Lab.

THEORY OF NEUTRON CHAIN REACTIONS: EXTRACTS FROM VOLUME I, DIFFUSION AND SLOWING DOWN OF NEUTRONS: CHAPTER I. ELEMENTARY THEORY OF NEUTRON DIFFUSION. CHAPTER II. SECOND ORDER DIFFUSION THEORY. CHAPTER III. SLOWING DOWN OF NEUTRONS, by Alvin M. Weinberg and L. C. Noderer. May 15, 1951. Decl. June 19, 1952. 202p. (AECD-3471; CF-51-5-98)

The three chapters presented were indexed as AECD-3405, 3410, and 3411 and abstracted in Nuclear Science Abstracts as NSA 6-4613, 6-4614, and 6-4615.

927

DETECTION OF POLARIZED NEUTRONS FROM THE D-D REACTION. E. Baumgartner and P. Huber. Helv. Phys. Acta 25, 626-8(1952) Nov. 1. (In German)

The D-D reaction has been suggested as a source of polarized fast neutrons. A method for determining the direction of spin and degree of polarization of these neutrons by measuring the dependence of their scattering (carbon) cross sections on the scattering angle is described. (G.Y.)

928

REMARKS ON SOME QUESTIONS OF NEUTRON OPTICS. Otto Halpern. Phys. Rev. 88, 1003-7(1952) Dec. 1.

Several derivations of the expression for the index of refraction of neutrons are discussed and difficulties recently raised are cleared up. The theory is extended to cover cases involving absorption (through capture or incoherent scattering). Formulas for the scattering due to disorder in crystals are used for the determination of scattering amplitudes of isotopes in agreement with direct experiments. It is shown how the polarization of neutrons scattered under small angles can be used to obtain information about the structure of mixed crystals. The problem of primary and

secondary neutron extinction is also discussed in the light of a recent publication. (auth)

NUCLEAR PHYSICS

929

Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro (Brazil)

ON THE PSEUDOSCALAR MESON THEORY OF THE DEUTERON, by J. Leite Lopes and R. P. Feynman. 1952. 5p. (NP-4221; Physics Note No. 2)

Attempt is made to correlate the present data on n-p forces (deuteron properties in particular) with the first-order nuclear potential predicted by the Yukawa pseudoscalar meson theory. (L.M.T.)

930

Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro (Brazil)

ON THE LOW ENERGY MU-MESONS FROM PI-MESON DECAY, by G. E. A. Fialho. 1952. 5p. (NP-4222; Physics Note No. 3)

The theoretical value for the frequency of μ mesons with energy smaller than 3.5 Mev, computed under the assumption of μ -meson spin of $\frac{1}{2}$ and no anomalous magnetic moment, is somewhat smaller than the experimental value. Because of this, the possibility of an anomalous magnetic moment is examined. (L.M.T.)

931

ON A POSSIBILITY OF COVARIANT GENERALIZATION OF THE THEORY OF INTERMEDIATE COUPLING. II.

Maurice Jean. *Compt. rend.* 235, 1197-9(1952) Nov. 17. (In French)

The possibility of generalizing Tomonaga's approximation, in view of the resolution of the equation proposed in a preceding note (NSA 7-654), is examined. A variational principle and possible trial functions are presented. (tr-auth)

932

PHOTON-INDUCED REACTIONS. D. C. Peaslee. *Phys. Rev.* 88, 812-16(1952) Nov. 15.

A detailed derivation is given of the Breit-Wigner formula for the case where one particle is a photon. The half width Γ_γ is found to have all the qualitative properties of a heavy-particle half width: It is proportional to the level spacing D and to $XP_1(X)$ where $X = \kappa R$ and P_1 is the penetration probability for an uncharged particle. Γ_γ also depends explicitly on the details of the many-particle structure of the compound state, so that single-particle estimates of Γ_γ appear to be of limited applicability. The formulas are applied to recent γ -n measurements on O^{16} , N^{14} , and F^{19} . The breaks in the O^{16} excitation curve are due to resonances in O^{16} , except for the threshold, which presumably does not represent a resonance. At higher energies the giant γ -n electric-dipole resonances are interpreted as indicating a certain "coherence" in the motion of the compound state, classically represented as countercurrent neutrons and protons. It is suggested that a flat shoulder in the excitation curves below the giant resonance may represent incoherent electric-dipole excitation rather than coherent magnetic-dipole and electric-quadrupole excitation. The matrix elements necessary to fit the measured magnitude are surprisingly large, which suggests that the one-particle wave functions have quite similar shapes in the ground state and in highly excited states. (auth)

933

MESON THEORY OF NUCLEAR FORCES AND LOW ENERGY PROPERTIES OF THE NEUTRON-PROTON SYSTEM.

Maurice M. Lévy. *Phys. Rev.* 88, 725-39(1952) Nov. 15.

A detailed analysis is made of the neutron-proton interaction yielded by the symmetrical pseudoscalar meson theory,

with pseudoscalar coupling, using the Tamm-Dancoff non-adiabatic method which has been extended to include nucleon-pair creation and higher-order effects in the exchange of mesons. It is found that, in the nonrelativistic region, the second- and fourth-order terms provide the main contribution to the interaction, the remaining part of the potential giving only a small correction. In the relativistic region, little can be said about the convergence of the interaction, but there are indications that it becomes strongly repulsive at distances comparable with the nucleon Compton wave length (\hbar/Mc). The radiative corrections to the potential are calculated in the nonrelativistic limit, using the equation of Bethe and Salpeter (*Phys. Rev.* 84, 1232(1951)), which has been transformed into a one-time equation by means of a method which has been given previously. It is shown that the corrections arising from vertex parts and closed loops in the Feynman diagrams are at most of the order of $(G^2/4\pi)(\mu/2M)^2$ times the term which they correct. There exists, however, a class of finite self-energy terms which give a contribution to the interaction having the same analytical form as the fourth-order potential, times a numerical factor which can be expressed as a power series in $G^2/4\pi$. The low-energy properties of the neutron-proton system are discussed, using the nonrelativistic potential which is calculated in this paper, and replacing the interaction in the relativistic region by a boundary condition prescribing that the wave function tends to zero at a finite distance r_c . It is found that a good agreement with experiment can be achieved by choosing $G^2/4\pi = 9.7 \pm 1.3$ and $r_c = (0.38 \pm 0.03)(\hbar/\mu c)$. Finally, an investigation of the neutron-proton scattering at 40 Mev shows that the same potential leads to a satisfactory description of the available experimental data. (auth)

934

THE ATOMIC NUCLEUS AS A COMPRESSIBLE DROP. II. THE OSCILLATING NUCLEAR DROP. K. Woeste. *Z. Physik* 133, 370-93(1952). (In German; cf. NSA 6-5658)

Proper frequencies were calculated, in the framework of the classical nuclear drop model, for the cases of (1) a homogeneous, compressible nuclear fluid and (2) an incompressible, two-component (protons and neutrons) mixed fluid. The results show lower proper frequencies than are given by the incompressible, single-component drop model. This lowering, which is a consequence of the greater "softness" of the models discussed, corresponds for fundamental vibrations with $l = 2$ to a small reduction in the threshold for spontaneous fission of about two units in Z with respect to the incompressible drop. Numerous new terms appear, especially for $l = 0$ and $l = 1$, which do not occur in the incompressible drop. Among these are found the Teller-Goldhaber terms with $l = 1$. (tr-auth)

935

THE ELECTRON-NEUTRON INTERACTION AS DEDUCED FROM PSEUDOSCALAR MESON THEORY. Burton David Fried. *Phys. Rev.* 88, 1142-9(1952) Dec. 1. (cf. NSA 6-4183)

Pseudoscalar meson theory with pseudoscalar coupling is used to find a value for the electron-neutron interaction. By means of the Feynman-Dyson-Wick techniques, the one-neutron matrix elements of the S matrix are calculated in the usual weak-coupling perturbation theory, carried to second order in the meson-nucleon coupling. Expressions for the magnetic moment and the electron-neutron interaction are deduced from this. By using the former to fix the coupling constant, it is found that the potential well representing the latter has a depth of 5380 ev if, as is conventional, this is taken to be square, with a radius of e^2/mc^2 . The various results found by previous authors and their relation to the present work are discussed. (auth)

NUCLEAR PROPERTIES

936

Atomic Energy Research Establishment, Harwell, Berks (England)
USE OF THE LINEAR ACCELERATOR FOR INVESTIGATING THE NUCLEAR CHARGE DISTRIBUTION, by F. Mandl. Jan. 1952. 6p. (AERE-T/M-54)

The feasibility of using a linear accelerator in the study of proton distribution in nuclei is discussed. Elastic scattering of electrons was used in the investigation. It is shown that on account of the radiative correction it does not seem possible to deduce anything about the nuclear charge distribution if one uses electrons of 10 to 15 Mev. At higher energies, 30 to 40 Mev, this would be possible though the accuracy of the measurements required might still make the experiments very difficult. (L.T.W.)

937

Radiation Lab., Univ. of Calif., Berkeley
SPONTANEOUS FISSION RATE OF Cf^{246} , by E. K. Hulet, S. G. Thompson, and A. Ghiorso. Nov. 6, 1952. 5p. (UCRL-2005)

A known quantity of Cf^{246} , produced by He ion bombardment of Cm, was placed as a thin deposit on one electrode of a parallel-plate ionization chamber and a stylus recorder maintained a record of each fission event and time of occurrence until essentially all of the Cf^{246} had decayed. The fission rate decreased with the same 35-hr half life previously observed for the α decay of Cf^{246} (Hulet, *Phys. Rev.* **84**, 366(1951)). The ratio of the α disintegration rate to the spontaneous fission rate was 5.2×10^5 , which gave a spontaneous-fission half life of 2100 yr. (L.M.T.)

938

EXPLICIT $\gamma\text{-}\gamma$ ANGULAR CORRELATIONS. II. POLARIZATION CORRELATIONS. Stuart P. Lloyd. *Phys. Rev.* **88**, 906-8(1952) Nov. 15.

The $\gamma\text{-}\gamma$ angular correlation function for the case where one or both of the γ -ray detectors is able to discriminate between plane polarization states of a γ -ray is given in terms of the corresponding $\gamma\text{-}\gamma$ directional correlation. The formulas given are directly applicable to one-three type correlations in a triple cascade, and also to direction-plane polarization correlations in which the unpolarized particle is not necessarily a γ -ray, e.g., β -polarized γ . Correlations for the case where the detectors are sensitive to circular polarizations are not treated. (auth)

939

ON THE STRUCTURE OF HEAVY NUCLEI. Osamu Miyatake. *Progress Theoret Phys. (Japan)* **7**, 285-302 (1952) Mar.

In this analysis the following assumptions are made on the structure of heavy nuclei whose atomic weights A are greater than 110: the nuclear matter is nearly incompressible and their constituent neutrons have a tendency to cluster into closed shells, which are of a spherical shape and arranged concentrically in the spherical nucleus; inner shells are bound more tightly than the outer ones; the proton density is determined only by the proper nuclear force and the coulomb repulsion, and is given by the formula $\rho(r) = C\{1 + 1/6 \cdot (r/7.3r_0)^2\}$; a shell mixed with the protons is called a core; a core is destroyed if at least one of its constituent neutrons or protons is knocked out; and the part thus destroyed is assumed to have a liquid-like behavior in the fissioning of heaviest nuclei, and the thermodynamical treatment is applied to this part only. Under these assumptions, (i) $r_0 = 1.32 \cdot 10^{-13}$ cm when $A \approx 200$ is obtained, (ii) the shape of the fission-yield curves of heaviest nuclei is explained, (iii) the released energy in the fission of U^{238} is about 195 Mev, (iv) the energy level spacing of heavy nuclei

is greater than that obtained from the uniform liquid-drop model, and (v) the cross section of the neutron inelastic scattering by heavy nuclei is smaller, and the velocity of the scattered neutron is larger than those so far obtained. The introduction of the core explains the irregularity of the intensity of the fluorescent γ ray emitted from nuclei and makes the specific heat of heavy nuclei smaller than that so far theoretically obtained. (auth)

940

THE 2^+ FIRST EXCITED STATE IN HEAVY EVEN-EVEN NUCLEI. A. H. Wapstra. *Physica* **18**, 799-800(1952) Oct.

The first excited state of even-even nuclei is in most cases found to be a 2^+ state. It is shown that in the region investigated (Hf^{180} to Pu^{242}) the excitation energy of this state is a smooth function of the numbers of protons and neutrons and has a pronounced maximum at the crossing of the magic numbers $N = 126$ and $Z = 82$. Probabilities of transitions involving these states are considered. A consequence of the existence of so low excited states for nuclides with $A > 220$ is that the α decay to these nuclides is a mixture of two α transitions. Therefore both the half life and the decay energy of the ground-state α transition of these nuclides are larger than assumed before except in the few cases measured with high-resolution instruments. (G.Y.)

941

ANGULAR AND DIRECTION-POLARIZATION CORRELATION FOR Co^{60} , Cs^{134} , AND Sb^{124} . Robert M. Kloepper, E. S. Lennox, and M. L. Wiedenbeck. *Phys. Rev.* **88**, 695-8(1952) Nov. 15.

Using the experimental techniques of Metzger and Deutsch (*Phys. Rev.* **78**, 551(1950)) the gamma-gamma angular and direction-polarization correlations have been measured for Co^{60} , Cs^{134} and Sb^{124} . The reliable results of previous investigations were confirmed for Co^{60} and served to check the instrument. The direction-polarization of Cs^{134} is consistent with a $4-2-0$; EQ,EQ spin assignment. The absence of gamma-gamma angular and direction-polarization correlation in Sb^{124} requires a multipole mixture for the upper transition and a $3-2-0$ spin assignment to the levels involved in the gamma-gamma transitions with no parity changes. The beta-gamma angular and direction-polarization correlation in Sb^{124} agrees with the $3-2-0$ spin assignments for the levels of the beta-gamma transitions and with an EQ gamma. (auth)

942

WIDTH OF SPECTRAL LINES AND HYPERFINE STRUCTURE IN X-RAY SPECTRA. Daniel Curie. *J. phys. radium* **13**, 505-15(1952) Nov. (In French)

In recent experiments, Frilley et al. (NSA 6-2478) noted the absence of a hyperfine-structure effect (broadening of K lines by the effect of nuclear magnetic moments) although theory predicts an observable order of magnitude. The possibility of explaining these results is considered, and it is shown that the usual theory of spectral line widths is not valid when photons of the same frequency can be emitted by two levels whose separation is less than their widths. The disagreement with classical results is manifested in two simultaneous aspects: (1) doubling of the line widths, and (2) deformation of the lines to such a degree that, if the separation of the two levels is sufficiently small, no separation of the corresponding lines is observed, in disaccord with the relation $E = h\nu$. These phenomena are connected with the existence of two electrons in the K shell and are not encountered in the simplified quasi-hydrogenous model of x-ray spectra. (tr-auth)

943

VALUES OF NUCLEAR SPINS ACCORDING TO THE SHELL MODEL. H. J. Maehly and P. Stähelin. *Helv. Phys. Acta* **25**, 624-5(1952) Nov. 1. (In German)

A table of the number of terms with total spin J in the configuration $(j)^n$ is presented. Thus, the number of possible different states for n equivalent nucleons in an outer shell can be found, strong spin-orbit coupling being assumed. (G.Y.)

944

HYPERFINE STRUCTURE OF THE Pb I λ 4058 Å. Andreas Steudel. *Z. Physik* **133**, 438-42(1952). (In German)

Fabry-Perot exposures were taken of the 4058-Å line of thorite Pb containing only Pb^{206} and Pb^{208} . The isotope shift $\text{Pb}^{208} - \text{Pb}^{206}$ was found to be $81.2 \pm 0.5 \times 10^{-3} \text{ cm}^{-1}$, differing from previous measurements. The position of Pb^{207} relative to Pb^{206} was measured on a photometer curve of an exposure of ordinary Pb. Best values were given for the structure of λ 4058 Å after consideration of all earlier work. (tr-auth)

945

ISOTOPE SHIFT IN THE GADOLINIUM I SPECTRUM.

Peter Brix and Hans Dietrich Engler. *Z. Physik* **133**, 362-9(1952). (In German) (cf. NSA 5-5985)

From measurements on 65 Gd I lines the following isotope shifts in 10^{-3} cm^{-1} for $\text{Gd}^{158} - \text{Gd}^{160}$ were determined for the terms of five electron configurations: $4f^7 5d^2 6s$, $+43 \pm 6$; $4f^7 5d 6s^2$, $+53 \pm 4$; $4f^7 5d 6s^2$, $+87 \pm 4$; and $4f^6 6s^2 6p$, $+ \sim 87$; all with respect to $4f^7 5d^2 6p$. The data are valid for levels assumed to be unperturbed; repeated observation of complex isotope shifts in these configurations were attributed to such perturbations. The isotopes Gd^{158} , Gd^{160} , and Gd^{160} were equidistant within the accuracy of the measurements. In contrast to the Sm I spectrum, no Gd I terms were found with isotope shift greater than that of the ground term $4f^7 5d 6s^2 a^4 D^0$. This observation confirms previous assumptions on the shielding effect of 4f electrons on the $5s^2$ shell. (tr-auth)

946

THE ALIGNMENT OF COBALT 58. J. M. Daniels, M. A. Grace, H. Halban, N. Kurti, and F. N. H. Robinson. *Phil. Mag.* (7) **43**, 1297-1300(1952) Dec.

The technique for obtaining aligned cobalt nuclei has been applied to the isotope Co^{58} . An examination of the angular distribution of the 0.805-Mev γ ray shows that this transition cannot be dipole but is probably quadrupole. The temperature dependence of this angular distribution gives for the nuclear magnetic moment a value of $3.5 \pm 0.3 \text{ n.m.}$ This result is discussed in relation to the nuclear shell model. (auth)

947

THE THERMAL NEUTRON CAPTURE CROSS SECTION OF ^{84}Sr . G. E. Harrison and F. D. Seymour. *Proc. Phys. Soc.* **A65**, 958-9(1952) Nov. 1.

The thermal neutron capture cross section of Sr^{84} has been determined by irradiating natural Sr in a reactor and measuring the disintegration rates of the $\text{Sr}^{86} \gamma$ activity and the $\text{Sr}^{89} \beta$ activity. From an accepted value of 0.005 barn for σ for Sr^{88} , the value obtained for the $\text{Sr}^{84} \sigma$ was 0.32 barn $\pm 20\%$. (L.M.T.)

948

SPIN-ORBIT COUPLING IN THE D-D REACTION. R. J. Blin-Stoyle. *Proc. Phys. Soc. (London)* **A65**, 949-50(1952) Nov. 1.

Because of spin-orbit coupling, the outgoing protons and neutrons from D-D reactions have been found to be polarized. For 300-kev incident deuterons, the experimentally determined proton polarization is $\sim 30\%$, while the calculated value, assuming that tensor forces alone are responsible for the spin-orbit coupling, is only $\sim 7\%$. This note attempts to resolve this discrepancy. (L.M.T.)

949

THE NUCLEAR SPINS OF ^{99}Ru AND ^{101}Ru . J. H. E. Griffiths and J. Owen. *Proc. Roy. Soc. (London)* **A65**, 951-2(1952) Nov. 1.

The paramagnetic resonance spectrum from a crystal of

$\text{Ru}(\text{NH}_3)_6\text{Cl}_2$ diluted with the diamagnetic salt $\text{Co}(\text{NH}_3)_6\text{Cl}_2$ has been measured at a wavelength of 1.2 cm and a temperature of 20°K. The hyperfine structure indicates that the nuclear spins of Ru^{101} and Ru^{99} are both $\frac{1}{2}$, and that the ratio of their magnetic moments (μ_{101}/μ_{99}) is 1.09 ± 0.03 . (auth)

950

NUCLEAR SPIN OF VANADIUM 50. J. M. Baker and B. Bleaney. *Proc. Phys. Soc. (London)* **A65**, 952-3(1952) Nov. 1.

By observation of the paramagnetic resonance spectrum at 1.3 cm wavelength of a sample enhanced to about 20%, the nuclear spin of V^{50} has been found to be six. This is the highest nuclear spin yet established. (auth)

951

AN EXPERIMENTAL INVESTIGATION OF THE STABILITY OF NUCLEI AGAINST DOUBLE BETA-DISINTEGRATION. J. H. Fremlin and M. C. Walters. *Proc. Phys. Soc. (London)* **A65**, 911-15(1952) Nov. 1.

Samples containing elements of even Z have been examined for possible beta activity using a photographic-emulsion technique. For the elements Cr, Fe, Ni, Zn, Ge, and Cd the results show that the effective half-value period for double beta decay for the elements as a whole is in each case greater than 10^{17} years if the disintegration energy is 2 Mev or more (or greater than 10^{16} years if the disintegration energy is 0.35 Mev or more). For Ca, Mo, Sr, Sn, Te, Ba, W, Os, and Pt lower limits between 2×10^{14} and 6×10^{16} years are similarly obtained on the assumption of 2 Mev disintegration energy, the residual uncertainty in most cases being due to the slight contamination of the samples with natural radioelements. A possible weak beta activity shown by samples containing Mo requires further examination. (auth)

952

THE NUCLEAR MOMENTS OF Ta^{181} . B. M. Brown and D. H. Tomboulia. *Phys. Rev.* **88**, 1158-62(1952) Dec. 1.

An analysis of the hfs pattern of several Ta II lines has made it possible to determine the separations of the three levels of the hfs multiplet associated with the $5d^3 6s^5 F_1$ state of Ta II. For this multiplet, the constants A and B appearing in the energy expression $W = W_J + \frac{1}{2}AK + BK(K+1)$ have the numerical values $A = (-0.079 \pm 0.001) \text{ cm}^{-1}$ and $B = (-0.77 \pm 0.4) \times 10^{-3} \text{ cm}^{-1}$. Calculations are carried out in order to evaluate the magnetic and quadrupole moments of the Ta^{181} nucleus. On the basis of the above measurements the magnetic moment is calculated by the Goudsmit-Fermi-Segré formula has the value of 1.9 nuclear magnetons. Taking into account effects due to the spatial extension of the nucleus, this result is raised to 2.1 n.m. when the correction factor of 12 percent as listed by Klinkenberg is applied. The result for the quadrupole moment as calculated by the Casimir formula is $+5.9 \times 10^{-24} \text{ cm}^2$. According to Sternhermer this moment should be increased by a factor of 10 percent to include the effect of an induced quadrupole moment in the closed shell electrons. With this correction the quadrupole moment has the value of $+6.5 \times 10^{-24} \text{ cm}^2$. 16 references. (auth)

953

THE EFFECT OF FINAL STATE INTERACTIONS ON REACTION CROSS SECTIONS. Kenneth M. Watson. *Phys. Rev.* **88**, 1163-71(1952) Dec. 1.

Particles produced in a reaction often interact strongly with each other before getting outside the range of their mutual forces. Formal effects of such interactions are discussed, and in particular it is shown that the effect for very strong attractive interactions can be calculated explicitly without having detailed knowledge of the properties of the reaction. Application is made to some meson phenomena. (auth)

954

THE EFFECT OF CHARGE SYMMETRY ON NUCLEAR REACTIONS. Norman M. Kroll, and Leslie L. Foldy. Phys. Rev. **88**, 1177-9(1952) Dec. 1.

For a charge-symmetric nuclear hamiltonian, the operator which changes neutrons into protons and protons into neutrons (charge parity operator) commutes with the hamiltonian and is therefore a constant of the motion. Since the charge-parity operator anticommutes with the "3" component of the total isotopic spin, for nuclei with $T_3 = 0$ (self-conjugate nuclei) the charge parity is a good quantum number and in the absence of degeneracy the eigenstates of such nuclei have either odd or even charge parity. This leads to strong selection rules in nuclear reactions involving self-conjugate nuclei in the initial and final states which may reasonably be invoked to explain recent experimental results on such reactions. Since states of even total isotopic spin have even charge parity and states of odd total isotopic spin have odd parity, the selection rules arising from charge symmetry often coincide with those of charge independence and in such cases a definitive test of the charge-independence hypothesis by the use of these selection rules is impeded. Some other applications of the charge symmetry principle are discussed. (auth)

955

AN ANALYSIS OF THE ENERGY LEVELS OF THE MIRROR NUCLEI, C^{13} AND N^{13} . R. G. Thomas. Phys. Rev. **88**, 1109-25(1952) Dec. 1.

An analysis employing the recent nuclear reaction theories of Wigner and others is given of the experimental data on the low-energy interactions of s, p, d orbital neutrons and protons with C^{12} and s neutrons and protons with O^{16} . Assuming the equality of nn and pp nuclear interactions, it is possible to account for the data on the s interactions if the level spacing is considered in addition to the customary two resonance parameters: reduced width and level position; in particular, the displacement of conjugate levels can be attributed to the difference of the external wave functions for the odd particle, although with an uncertainty of about 25 percent which is due primarily to the lack of precise knowledge of the internal coulomb energy of the excited states. The large magnitudes of the reduced width and level spacing indicate that two-body potential interactions exist between the odd particle and the C^{12} and O^{16} cores, and the values of the respective logarithmic derivatives indicate that these interactions are of about equal strengths. The energy dependence of the radiative capture cross section of s neutrons and protons with C^{12} can be understood if an additional quantity, the final-state reduced width, is included in the theory to take into account the energy-dependent external contribution to the transition moment. The experimental data are only sufficient to treat the p and d interactions in the one-level approximation: a reasonable explanation can be given of the observed displacements of conjugate levels in terms of the differences of the electromagnetic properties of the odd particle such as: external wave functions, spin-orbit interactions, and variations of the internal coulomb energy. There is some indication from the data on radiative transitions that the independent-particle model also prevails in the p states; on the other hand, the small reduced widths of these states suggest a many-body description. Derivations based on the recent theories are given of the one-channel formulas and of the general one-level formulas which include the negative-energy alternatives. The radial dependences of the resonance parameters are discussed. 86 references. (L.M.T.)

956

SPIN ECHO MEASUREMENTS OF NUCLEAR SPIN COUPLING IN MOLECULES. E. L. Hahn and D. E. Maxwell. Phys. Rev. **88**, 1070-84(1952) Dec. 1.

A new type of nuclear spin-spin coupling in molecules in liquids is investigated by means of the spin-echo technique. A coupling interaction of the rotationally invariant form $\hbar J_1 \cdot I_2$ in the nuclear induction hamiltonian predicts the detailed shape of the spin-echo envelope. Echo modulation frequencies corresponding to the coupling J and the chemical shift between nonequivalent protons are measured in a variety of compounds. A generalized method for calculating the spin echo is presented for large chemical shift and weak coupling among an arbitrary number of spins. The damping of the echo modulation, due to spin relaxation and molecular effects which interrupt the J coupling, is accounted for by a phenomenological treatment of the quantum-mechanical expectation value of nuclear magnetization. 31 references. (L.M.T.)

957

MAGNETIC MOMENTS AND QUADRUPOLE MOMENTS OF ODD-MASS NUCLEI IN jj-COUPPLING. B. H. Flowers. Phil. Mag. (7) **43**, 1330-4(1952) Dec.

Magnetic moments and quadrupole moments of nuclei are treated in a model which considers all particles outside the core of completed levels on an equal footing. It is shown that in this way better agreement with experimental magnetic moments is obtained than from the simpler Schmidt model. The manner in which electric quadrupole moments arise in odd-neutron nuclei without the assumption of a deformable core is also discussed. (auth)

958

NUCLEAR MASS DETERMINATIONS FROM DISINTEGRATION ENERGIES; OXYGEN TO SULFUR. C. W. Li. Phys. Rev. **88**, 1038-42(1952) Dec. 1.

Values of the atomic masses from O^{18} to S^{33} have been derived from the Q values of nuclear reactions with a procedure of statistical adjustment. Tables are given of the most probable Q values and the atomic masses. In combination with a previous calculation, they give a set of consistent mass values from n^1 to S^{33} , based on nuclear disintegration energies. (auth)

NUCLEAR REACTORS

959

Oak Ridge National Lab., Y-12 Area
REACTOR THEORY TERMS, by C. B. Mills and George B. Arfken. July 16, 1952. Decl. with deletions Dec. 4, 1952. 128p. (AECD-3477; Y-F10-106)

This glossary was originally issued as ORNL-84. It has been revised and edited, incorporating many suggestions of the Nuclear Engineering Glossary Committee of Oak Ridge National Lab. (L.M.T.)

960

APPLICATIONS OF PILE-KINETIC EQUATIONS. H. S. Isbin and J. W. Gorman. Nucleonics **10**, No. 11, 68-71(1952) Nov.

Step changes in reactivity, which may occur in operation of a reactor, result in flux transients. A method of analytical solution for the thermal-flux transients that follow step changes in graphite-U reactors is given. A method is explained for finding the coefficients and exponents of the series solution of the time-dependent kinetic equations. (L.T.W.)

961

STORAGE OF RADIOACTIVE GASES FROM REACTOR OPERATION. Raymond L. Murray. Nucleonics **10**, No. 12, 52-3(1952) Dec.

A mathematical analysis is presented of the discharge of gaseous fission products in intermittent reactor operations. Storage systems considered are a single long pipe, a single vessel of large capacity, and a sequence of vessels. (auth)

NUCLEAR TRANSFORMATION

662

FISSION AND THE SHELL MODEL OF THE ATOMIC NUCLEUS. Lise Meitner. *Arkiv Fysik* **4**, 383-6(1952). (In German)

The relation of thermal fission, fast fission, spallation, and similar processes to magic numbers is discussed briefly and generally. 11 references. (G.Y.)

663

NEUTRON CAPTURE CALCULATIONS. Henry C. Ott. *Nucleonics* **10**, No. 11, 116-21(1952) Nov.

Van Wye and Beckerley (NSA 5-7256) presented a generalized method for calculating consecutive nuclear transformations including neutron absorption as well as radioactive decay. For long chains evaluation of the coefficients A_{ij}^{mn} becomes tedious, and individual terms in the summation are often orders of magnitude larger than N_{ij} so that dependable accuracy can be obtained only by using extended tables of exponentials. An alternate general expression in power-series form is developed by the present author which overcomes these defects and which permits calculation to sufficient accuracy with a sliderule and without recourse to tables of exponentials. (L.T.W.)

664

A MASS SPECTROGRAPHIC DETERMINATION OF THE DECAY ENERGIES OF Rh^{102} AND Rh^{104} . Benjamin G. Hogg and Henry E. Duckworth. *Can. J. Phys.* **30**, 637-42(1952) Nov.

Mass spectrographic measurements are reported of the following mass differences: $\frac{1}{2}Pb^{204}-Ru^{102}$, $\frac{1}{2}Pb^{204}-Pd^{102}$, $\frac{1}{2}Pd^{206}-Rh^{103}$, $\frac{1}{2}Pb^{208}-Ru^{104}$, and $\frac{1}{2}Pb^{208}-Pd^{104}$. These results are combined with existing transmutation data to obtain the energies available for the disintegrations $Rh^{102} \rightarrow Ru^{102}$, $Rh^{102} \rightarrow Pd^{102}$, $Rh^{104} \rightarrow Pd^{104}$, and $Rh^{104} \rightarrow Ru^{104}$. In the first three cases the energy values are in substantial agreement with those found by beta-ray spectroscopy. The final disintegration, namely, $Rh^{104} \rightarrow Ru^{104}$, is found to possess enough energy for appreciable K capture and a lesser degree of positron activity. These activities have not yet been observed. Atomic masses are given for Ru^{102} , Pd^{102} , Rh^{103} , Ru^{104} , and Pd^{104} . (auth)

665

NOTE ON THE POLARIZATION OF PROTONS AND NEUTRONS FROM THE D-D REACTION. M. Fierz. *Helv. Phys. Acta* **25**, 629-30(1952) Nov. 1. (In German)

Conclusions that can be drawn from measurements of the polarization of particles from the D-D reaction are discussed. In particular, the question whether the existence of singlet-triplet transitions can be decided from the behavior of the polarization as a function of deuteron energy is investigated. (tr-auth)

966

ANGULAR DEPENDENCE AND YIELD OF THE $Be^9(d,p)Be^{10}$ AND $Be^9(d,t)Be^8$ REACTIONS. D. De Jong, P. M. Endt, and L. J. G. Simons. *Physica* **18**, 676-82(1952) Oct.

Differential cross sections have been measured of the $Be^9(d,p)Be^{10}$ and $Be^9(d,t)Be^8$ ground-state transitions at five deuteron energies between 0.30 and 0.62 Mev. The proton angular distributions can be developed into series of Legendre polynomials of which the highest term is a_4P_4 , while the developments of the triton distributions above $E_d = 0.45$ Mev need also the terms a_2P_2 and a_4P_4 . The total cross sections of the two reactions are equal within the experimental error below $E_d = 0.45$ Mev, while above this energy the $Be^9(d,p)Be^{10}$ reaction predominates. (auth)

967

THE THEORY OF (d,t) REACTIONS. H. C. Newns. *Proc. Phys. Soc. (London)* **A65**, 916-19(1952) Nov. 1.

Expressions for the angular distribution of tritons emitted from nuclei bombarded with deuterons have been obtained using Born's approximation and the non-perturbation method of Butler (*Proc. Roy. Soc. A208*, 559(1951)). Discussion of the effect of different forms of the triton wave function on the angular distribution is given. The theory is shown to explain the experimental angular distributions satisfactorily. (auth)

968

FISSION-TO-CAPTURE CROSS-SECTION RATIO. John R. Huizenga and Robert B. Duffield. *Phys. Rev.* **88**, 959-60(1952) Nov. 15.

A correlation is pointed out between the thermal neutron fission cross section σ_f of a given nucleus (Z,A), the neutron capture cross section σ_c of (Z,A), and the binding energy of a neutron to (Z,A). From a table of the binding energies and thermal neutron fission and capture cross sections of 11 nuclides, Th^{230} through Cm^{242} , $\log[\sigma_f(Z,A)/\sigma_c(Z,A)]$ is plotted against neutron binding energy. The plot shows that $\log(\sigma_f/\sigma_c)$ decreases rapidly with decreasing neutron binding energy. Irregularity is shown in the plot when the binding energy decreases to 5.4 Mev, indicating that the fission mechanism may be considerably different in this region. (L.M.T.)

969

(γ ,pn) REACTION IN PHOSPHORUS. J. Halpern, A. K. Mann, and R. Nathans. *Phys. Rev.* **88**, 958(1952) Nov. 15.

The (γ ,pn) contribution to the total cross section has been measured in P, using the same technique as in the (γ ,2n) method (*Phys. Rev.* **88**, 679(1952)). The radioactivity yield from the (γ ,n) reaction is measured as a function of the maximum energy of bremsstrahlung produced by the Univ. of Pennsylvania betatron and compared to the yield curve of neutrons directly counted. A plot of the two shows identical curves up to 18 Mev where divergence occurs, which is attributed to the onset of the (γ ,pn) reaction. Excitation functions are then constructed from the plot, using the calculated bremsstrahlung spectra at the various betatron energies. (L.M.T.)

970

ANGULAR CORRELATIONS IN THE REACTION $^{15}N(p,\alpha\gamma)^{12}C$. J. Seed and A. P. French. *Phil. Mag.* (7) **43**, 1214-16(1952) Nov.

Proton bombardment of N^{15} was studied by Schardt et al. (1952), who found several resonant states of O^{16} for which the principal mode of decay is to the 4.47-Mev level of C^{12} by emission of low-energy α particles. The present authors studied the angular correlation between these α particles and the subsequent γ rays at the 898-kev resonance, which is sufficiently strong and isolated to be regarded as a pure state. A high order of anisotropy was observed in the (α - γ) correlations. The results can be fitted if one assumes that the incoming protons have orbital momentum 2 and that the nucleus O^{16} has spin 2 and odd parity. On these assumptions the theoretical correlation functions are $I(\theta, \pi/2) = 1 - 6 \cos^2\theta/(6+f)$ for the (α - γ) correlation in a plane perpendicular to the incident proton direction and $I(\theta, 0) = 1 + (5f-6)\cos^2\theta/6 - 2f\cos^4\theta/3$ for the correlation in a plane containing the incident proton direction, and f is the relative probability of forming the O^{16} nucleus from the parallel and antiparallel spin configurations, respectively, of the colliding particles. (L.T.W.)

971

MAGNETIC ANALYSIS OF THE $Al^{27}(d,p)Al^{28}$ REACTION. H. A. Enge, W. W. Buechner, and A. Sperduto. *Phys. Rev.* **88**, 963-8(1952) Dec. 1.

Thin aluminum targets have been bombarded with 1.8-, 2.0-, and 2.1-Mev deuterons. Protons emerging at 90 degrees with respect to the deuteron beam have been analyzed in a magnetic spectrograph. Fifty proton groups have been

assigned to the $Al^{27}(d,p)Al^{28}$ reaction, corresponding to the ground state and forty-nine excited states in Al^{28} between 0 and 6.35 Mev. Most of the levels form clusters, and spacings as low as 13 kev have been observed. (auth)

972

ANGULAR CORRELATIONS IN THE REACTION $F^{19}(p,\alpha\gamma)O^{16}$. J. Seed and A. P. French. *Phys. Rev.* **88**, 1007-16(1952) Dec. 1.

The angular correlations between alpha particles and gamma rays in transitions between states of Ne^{20} and the low excited states of O^{16} have been studied at the 669-, 874-, and 935-kev resonances for proton capture in fluorine. The alpha-particle groups were separated magnetically from each other and from scattered protons. The results lead to definite assignments of spin and parity to the nuclear states involved, and show that the first four excited levels of O^{16} are consistent with a simple alpha-particle model for this nucleus. Where interference between states occurs in the reaction, the phase differences are in accord with the predictions of modern dispersion theory. (auth)

PARTICLE ACCELERATORS

973

Microwave Lab., Stanford Univ.
PULSERS FOR THE STANFORD LINEAR ELECTRON ACCELERATORS, by Paul A. Pearson. Nov. 1952. 268p. (ML-173; U-25434)

The requirements, developmental and engineering problems, and solutions for the klystron pulsers used with the 35-Mev and the 1-bev linear electron accelerators at Stanford University Microwave Laboratory are discussed. The klystron amplifiers furnish r-f power to the accelerators and require pulses of 400 kv, 100 Mev, and 2 μ sec. Design procedures, specifications, and performance of the pulser components are given. The report can be used as an instruction manual for the operators of the Stanford accelerators. (L.T.W.)

974

PRODUCTION OF RADIOISOTOPES IN THE SYNCHROCYCLOTRON. Halberstadt. *J. belge radiol.* **35**, 561-8(1952). (In French)

The Philips synchrocyclotron at the Institut de Recherche de Physique Nucléaire at Amsterdam and the techniques used therewith to produce radioisotopes are described briefly. The yields in millicuries per hour of numerous radioisotopes obtained with a 27-Mev, 20-ma deuteron beam are tabulated. (G.Y.)

975

RADIATION CHARACTERISTICS OF HIGH-ENERGY ELECTRON ACCELERATOR TARGETS. J. D. Lawson. *Nucleonics* **10**, No. 11, 61-5(1952) Nov.

Spectral and angular distributions of the radiation for incident electrons above 5 Mev are given for a useful range of target thicknesses. Radiation characteristics for targets outside this range are described qualitatively. (auth)

RADIATION ABSORPTION AND SCATTERING

976

AECU-2326
Los Alamos Scientific Lab.
ELASTIC SCATTERING OF PROTONS AND NEUTRONS BY DEUTERONS, by R. S. Christian and J. L. Gammel. [nd] 64p. (AECU-2326; LAQD-1311)

Phase shifts for p-d and n-d scattering are calculated in Born approximation for partial waves with $l \geq 1$. These are used as a starting point for a phase shift analysis of the p-d data in the energy range 0 to 10 Mev. For $l \geq 1$, the phase shifts resulting from the phase-shift analysis agree with those calculated in Born approximation. The 4S and 2S phase shifts have a reasonable energy dependence; that is, the

"k cot δ " plots are smooth functions of the energy and extrapolate to a set of scattering lengths near one of the known sets of n-d scattering lengths. It is concluded that the correct set of n-d scattering lengths is $a_1 = 6.2 \pm 0.2 \times 10^{-13}$ cm and $a_2 = 0.8 \pm 0.3 \times 10^{-13}$ cm. Since this is in disagreement with some previous theoretical conjectures, the scattering lengths and S phase shifts in the energy region 0 to 10 Mev are calculated using a variational method with neglect of polarization (a theoretical estimate of the effect of polarization is made) and the results support the conclusion. n-d angular distributions are calculated and compared with experiment. The agreement of the theoretical results with the experimental ones provides a strong "a fortiori" justification of conclusions drawn from the theory about the importance of the internucleonic potentials in low-energy p-d and n-d scattering. The scattering is nearly independent of the odd parity n-p potentials and of the forces between like particles. Furthermore, it is nearly independent of the shape of the 3S and 1S n-p potentials. However, the 3S scattering length is sensitive to the singlet even-parity n-n potential, and is calculated as a function of the depth of this potential. It is insensitive to other n-n potentials. (auth)

977

Radiation Lab., Univ. of Calif., Berkeley
NUCLEAR ABSORPTION CROSS SECTIONS FOR HIGH ENERGY PROTONS (thesis), by Albert John Kirschbaum. Oct. 1952. 43p. (UCRL-1967)

The nuclear absorption cross sections have been measured for Be, C, Al, Cu, Pb, and U for cyclotron protons with energies of 160 to 335 Mev. Data are presented for the measured cross sections of each of the elements in energy bands of 335 to 270, 270 to 205, and 205 to 160 Mev. Comparison is made of the measured absorption and diffraction cross sections for protons and neutrons in the 300 to 180 Mev range. Plots are given of the measured values of σ_a for protons vs. energy and of σ_a vs. A on a log-log scale. (L.M.T.)

978

Radiation Lab., Univ. of Calif., Berkeley
THE HIGH-ENERGY CHARGED PARTICLES FROM TARGETS BOMBARDED BY 190 MEV DEUTERONS (thesis), by Larry Schecter. Oct. 28, 1952. 73p. (UCRL-1996)

An investigation has been made of the angle and energy distributions of the high-energy charged particles which emerge from beryllium, carbon, and uranium nuclei bombarded by 190-Mev deuterons. The results indicate that the yields can be explained as primarily due to two kinds of processes; nucleon-nucleon interactions, and stripping. Under this assumption, the total stripping cross section has been determined to be 0.35 ± 0.03 barns for the lighter elements and 2.6 ± 0.4 barns for uranium. These values suggest an $A^{2/3}$ dependence for this cross section. (auth)

979

Radiation Lab., Univ. of Calif., Berkeley
ANGULAR DISTRIBUTION OF PHOTONS IN SHOWERS, by Jack W. Rosengren. Oct. 31, 1952. 24p. (UCRL-1998)

A study has been made of the angular distribution of the photons in electron-photon cascade showers initiated in Cu and Pb by high-energy bremsstrahlung radiation. Targets of thicknesses 1.17, 2.52, and 5.30 radiation lengths of Pb and 0.85 radiation lengths of Cu were exposed individually to the 322-Mev bremsstrahlung beam of the Berkeley synchrotron. The angular distribution of all but the lowest energy photons emerging from the far side of the targets should be identical with the distributions at the same depths in an infinite medium. The photons were detected by the beta activity produced in Cu foils by the $Cu^{63}(\gamma,n)Cu^{62}$ reaction. This reaction is known to be produced mainly by

photons of energies near 17.5 Mev. Evidence is presented that the observed activity was not produced by electrons or neutrons. The target thicknesses of Pb employed corresponded to depths in the shower of $T/2$, T and $2T$, where T is the depth of the shower maximum. Angular distributions were measured in the range from 6° to 50° . Rough agreement is shown between the results and the theoretical calculations of Eyges and Fernbach. (auth)

550

RELATION OF ELECTRON SCATTERING TO ATOMIC NUMBER. B. K. Vainshtein. Doklady Akad. Nauk S.S.S.R. 85, 1239-42(1952) Aug. 21. (In Russian)

981

DIFFERENCES IN THE ABSORPTION COEFFICIENTS OF PURE WATER AND SEA WATER PREDICTED BY X-RAY THEORY. Bernard Saint-Guilly. Compt. rend. 235, 893-4 (1952) Oct. 20. (In French)

Absorption of x rays by the photoelectric and Compton effects in pure water and sea water (considered as a solution of NaCl only) has been calculated for the range 0.100 to 23.3 A. No great difference exists between the two sets of figures. Some experimental data on pure water are compared with the calculations. It is stated that no measurements exist on the absorption of x or γ rays in sea water. (G.Y.)

552

NUCLEAR CROSS SECTIONS FOR FAST NEUTRONS AND INTERACTION BETWEEN HIGH ENERGY NUCLEONS.

Kojiro Ida. Progress Theoret. Phys. (Japan) 7, 269-74 (1952) Mar.

Recent observation of proton-proton scattering shows that the agreement with existing phenomenological theories based on static potential is rather poor, and considerations of velocity-dependent forces are required. It is shown, however, that the only familiar velocity dependent force, spin-orbit coupling introduced by Case and Pais, is not acceptable from the consideration of high-energy neutron-nucleus scattering. (auth)

553

ON AN ELECTRON-ELECTRON ANGULAR CORRELATION. Jacques Marcel Blum. Compt. rend. 235, 948-50(1952) Oct. 27. (In French)

On irradiating Ilford G5 emulsions with W $K_{\alpha 2}$ x rays and counting the electron tracks from both Ag and Br atoms, the existence of an angular correlation between the primary photoelectrons and the associated Auger electrons was observed. The difficulties of explaining these results, either by the experimental conditions or by the nature of the Auger process, are indicated. (G.Y.)

554

PROTON INDUCED REACTIONS OF THORIUM—FISSION YIELD CURVES. Howard A. Tewes and Ralph A. James. Phys. Rev. 88, 860-7(1952) Nov. 15.

The fission yields of a number of nuclides produced in proton-induced fission of Th^{232} were determined at several proton energies in the range of 6.7 Mev to 21.1 Mev. At the same time, the relative cross sections of the (p,n) and (p,3n) reactions on Th^{232} were also determined. It was found that, although the fission reaction was predominant at proton energies greater than 8 Mev, competition from the (p,xn) type of reaction was considerable over all energies investigated. The trough in the fission yield curve becomes shallower with increasing proton energy and this change was quantitatively determined over the energy range investigated. A model is proposed to explain the change in shape of the fission yield curves. An approximate determination of the excitation function for the (p,f) reaction was made; the shape of the resulting curve was at least qualitatively in agreement with the excitation function predicted from existing theory. (auth)

555

PAIR PRODUCTION BY ELECTRONS. M. Camac. Phys. Rev. 88, 745-50(1952) Nov. 15.

Pair production by electrons was observed by measuring the positrons emitted from thin copper targets irradiated directly by the synchrotron electron beam (230 ± 20 Mev energy). The positrons were produced in either of two ways: either (1) directly by the electron beam, or (2) through a double process in which bremsstrahlung was first produced which then materialized in pairs in the same target. By measuring the positron rate as a function of target thickness a direct comparison of the two modes of production was obtained. The thickness of copper from which the positron yield was the same for both processes was 0.0043 ± 0.001 inch (0.0073 ± 0.0017 radiation lengths). The positrons had about 0.80 of the energy of the incident electron beam. The results of this experiment is shown to be in agreement with the Weizsaker-Williams, approximation (Phys. Rev. 45, 729 (1934)). In this approximation the formula for the number of virtual quanta associated with an incident electron contains a constant of the order of unity. Using the results of this experiment and the Bethe-Heitler formulas for the double process this constant was calculated to be 1.6 ± 0.2 . (auth)

986

PROTON TRITON INTERACTION. J. S. McIntosh, R. L. Gluckstern, and S. Sack. Phys. Rev. 88, 752-9(1952) Nov. 15.

A phase-shift analysis of the Los Alamos data on p-t scattering for incident protons of 0.708 to 2.548 Mev is carried out using singlet and triplet s and p phase shifts. The large p-wave phase shifts obtained are shown to be consistent with the suggested 1P resonant level of the α particle. The effect of absorption associated with the $T(p,n)\text{He}^3$ reaction is taken into account by means of a schematic resonance model. A satisfactory fit is obtained with attractive singlet and triplet potentials of depths ~ 46 Mev and ~ 11 Mev, respectively. The singlet depth is chosen to give the observed bound state of the α particle. (auth)

987

SMALL ANGLE X-RAY SCATTERING FROM COMPACT IDENTICAL PARTICLES. R. M. Frank and K. L. Yudowitch. Phys. Rev. 88, 759-60(1952) Nov. 15.

A general expression is deduced for the intensity distribution of x rays scattered at small angles from a compact system of identical particles. The scattering element selected for this derivation includes several near neighbors with the origin particle, thus taking cognizance of short-range order. An inherently positive intensity distribution may then be deduced for any such system describable by an "average" radial electron density which may be approximated by linear segments. This approximation for a compact system of impenetrable spheres compares favorably with the meager data available. (auth)

559

INVESTIGATIONS ON POSITRON-ELECTRON SCATTERING. R. R. Roy and L. Groven. Phil. Mag. (7) 43, 1291-6(1952) Dec.

The scattering of positrons by electrons has been studied in nitrogen by a cloud-chamber method. In 6000 photographs, 5600 positrons were measured, giving a total track length of 792 meters between the energies 0.5 Mev and 1.1 Mev. The experimental results, when compared with the exchange theory of Bhabha (Proc. Roy. Soc. A 154, 195), show satisfactory agreement. (auth)

559

SOME PROPERTIES OF LINES ON DIVERGENT-BEAM X-RAY PHOTOGRAPHS. A. G. Peace and G. E. Pringle. Phil. Mag. (7) 43, 1227-42(1952) Dec.

The quantitative aspect of x-ray extinction is reconsidered

in its particular relation to divergent-beam photography. Special consideration is given to the optical resolution obtainable with the usual experimental arrangements, and some experimental data on unresolved lines are discussed. This leads to a determination of the mosaic spread of crystals previously conditioned by liquid air treatment to minimize primary extinction effects, but, in general, quantitative conclusions are hampered by the usual doubt as to how much of the observed extinction is primary and how much secondary. (auth)

590

ELECTRON CAPTURE. I. RESONANCE CAPTURE FROM HYDROGEN ATOMS BY FAST PROTONS. D. R. Bates and A. Dalgarno. *Proc. Phys. Soc. (London)* **A65**, 919-25(1952) Nov. 1.

Born's approximation is used to calculate the cross section associated with resonance charge exchange between protons and hydrogen atoms, it being pointed out that in earlier treatments of this problem, unjustified simplifying assumptions were made. An energy range of up to 250 kev is covered. The predicted energy variation of the cross section is in harmony with the results of Ribe's recent laboratory work on collisions of protons with hydrogen molecules. (auth)

591

CROSS SECTION AND ANGULAR DISTRIBUTION OF THE $D(d,p)T$ REACTION. W. A. Wenzel and Ward Whaling. *Phys. Rev.* **88**, 1149-54(1952) Dec. 1.

The $D(d,p)T$ reaction cross section has been measured by two methods using D_2O ice targets. For E_d from 206 to 516 kev, a double-focusing magnetic spectrometer was used to obtain the momentum spectrum of the protons and tritons, from which the reaction cross section can be determined. For E_d from 35 to 550 kev, the proton yield from a thick target was differentiated to obtain the cross section. Both thin and thick target methods were used to measure the angular distribution over the energy range E_d from 35 to 550 kev. The angular distribution is expressed in terms of a Legendre polynomial expansion. Various sources of experimental error are considered and the probable error of the total cross section is found to be ± 5 percent. (auth)

592

MAGNETIC LENS SPECTROMETER MEASUREMENTS OF THE RADIATIONS FROM LIGHT NUCLEAR REACTIONS. R. G. Thomas and T. Lauritsen. *Phys. Rev.* **88**, 969-86(1952) Dec. 1.

The radiations from a number of light nuclear reactions are studied with a magnetic-lens spectrometer. The γ -ray energies and intensities are determined from the photoelectric and Compton conversion processes; a new method for intensity measurements is developed in which "thick" Compton converters are used. The complicating effects of Doppler shift and broadening on energy determinations are discussed. The following transition energies, obtained from thick targets at bombarding energies from one to two Mev, are reported: $C^{13}(d,n)N^{14}$: 725 ± 4 (assignment uncertain), 1838 ± 8 , 2310 ± 12 , 3381 ± 13 , 5052 ± 25 , and 5690 ± 50 kev; $C^{13}(d,p)C^{14}$: 6110 ± 30 kev; $C^{12}(d,p)C^{13}$: 3082 ± 7 kev; $N^{15}(p,\alpha)C^{12}$: 4443 ± 20 kev; $B^{10}(p,\alpha)Be^7$: 428.5 ± 1.8 kev; $Li^6(d,n)Be^7$: 428.9 ± 2 kev; $Li^6(d,p)Li^7$: 477.4 ± 2 kev; $O^{16}(d,p)O^{17}$: 870.5 ± 2 kev. The internally formed positron distribution from the 3.08-Mev transition in C^{13} is found to be in agreement with the theoretical distribution for an electric dipole transition; the internally formed positron distributions from $C^{13} + d$ and $Be^9 + d$ are also observed but because of the uncertainty of the background, it is not possible to make unambiguous multipole assignments. The observed internal-conversion-line spectrum from the 870-kev transition of O^{17}

indicates that the transition is electric quadrupole or a mixture of this and magnetic dipole. Semi-empirical formulas are given in the appendix for the most probable and effective energy losses of fast electrons traversing light materials. (auth)

593

THE INTERACTIONS OF HIGH ENERGY NUCLEONS WITH NUCLEI. II. G. Bernardini, E. T. Booth, and S. J. Lindenbaum. *Phys. Rev.* **88**, 1017-26(1952) Dec. 1.

Part I of this paper presented an analysis of the experimentally observed interactions of 300- to 400-Mev protons and neutrons with the nuclei of G-5 emulsion. General evidence for the nucleonic-cascade mechanism of interaction was deduced from these results. Goldberger (*Phys. Rev.* **74**, 1268(1948)) had previously calculated the interaction of high-energy nucleons (~ 90 Mev) with heavy nuclei on the basis of an internal nucleonic cascade generated in a Fermi nucleon gas. However, the experimental test of these calculations by Hadley and York (*Phys. Rev.* **80**, 345(1950)) was indecisive. Calculations basically similar to the Goldberger type were performed for these interactions, employing the Monte Carlo method to treat the rather complicated cascades involved. The theoretical and experimental results are compared in detail and found to be essentially in agreement within error limits. Hence it is concluded that the nucleonic-cascade mechanism can satisfactorily explain these interactions. (auth)

RADIATION EFFECTS

594

Massachusetts Inst. of Tech. Engineering Practice School, Oak Ridge

EVOLUTION OF HALIDES FROM HALOGENATED PLASTICS EXPOSED TO GAMMA RADIATION, by J. Byrne and W. L. Mann. Issued Nov. 15, 1952. 24p. (K-981)

The purpose of the investigation was to study the effects of gamma radiation from a Co^{60} source on the physical properties and halogen evolution from the plastics polyvinyl chloride and polymonochlorotrifluoroethylene. Samples exposed for 2 to 28 days to a source of approximately 25,000 r/min showed an appreciable evolution of both fluorine and chlorine. Tests on polymonochlorotrifluoroethylene for tensile, impact, and shear strength showed rapidly decreasing values as the radiation exposure was increased. Similar physical tests on exposed polyvinyl chloride showed increased impact and shear strengths and a lower tensile strength. (auth)

595

ON A MODIFICATION OF JAFFÉ'S THEORY OF COLUMN-IONIZATION. H. A. Kramers. *Physica* **18**, 665-75(1952) Oct.

A modification of Jaffé's (*Ann. Physik* (4) **42**, 303(1913)) theory of column ionization has been developed, this theory being in contradiction with the results of ionization experiments in liquefied gases at low temperatures. A critical analysis of the importance of each term in the equation of motion reveals that in the case of low temperatures the diffusion term has to be omitted *ab initio*. This procedure gives rise to a solution which, for currents small compared with the saturation current, differs markedly from Jaffé's solution and which is in better agreement with the experimental results. (auth)

596

COLORATION OF OPTICAL GLASS BY HIGH-ENERGY RADIATION. George S. Monk. *Nucleonics* **10**, No. 11, 52-5(1952) Nov.

The theory and prevention of glass coloration is described qualitatively. The results of radiation coloration experiments on crown glass, flint glass, Ba crown glass,

and B-containing glass are reported. The B glass showed a marked darkening at all edges, decreasing in coloration from the face of the glass toward the inside. (L.T.W.)

997

THE EFFECT OF CYCLOTRON BOMBARDMENT ON SELF-DIFFUSION IN SILVER. R. D. Johnson and A. B. Martin. *J. Applied Phys.* 23, 1245-54(1952) Nov.

Radioactive tracer techniques have been employed to measure the rate of self diffusion in silver in polycrystalline and single-crystal solvents over a wide range of temperatures, and to investigate the effect of bombardment with 10-Mev protons on this diffusion process. A least-squares fit of the data from laboratory-control experiments with both single crystal and polycrystalline solvents in the temperature range 903°C to 640°C has yielded the diffusion constants $Q = 40,800 \pm 700$ cal/mole and $D_0 = 0.11 \pm 0.05/\text{cm}^2/\text{sec}$ for the volume-diffusion process. No effect of intense proton bombardment ranging from 0.5 to $5\mu\text{a}/\text{cm}^2$ has been detected on the volume self-diffusion process in silver specimens which were simultaneously irradiated in the cyclotron target box and annealed at temperatures ranging from 852 to 555°C. These results are, at least semiquantitatively, in accord with both the elastic collision model and the thermal spike model of radiation damage. Cyclotron techniques and apparatus are described in some detail. (auth)

RADIOACTIVITY

998

Brookhaven National Lab.

THE PROBABLE EXISTENCE OF AN E3 + M4 MIXTURE IN AN ISOMERIC TRANSITION, by R. D. Hill and J. W. Mihelich. [nd] 4p. (BNL-1294)

The 74.2-keV isomeric transition of $\text{Os}^{191\text{m}}$ has been re-examined. Discrepancies have arisen in following up the previous conclusions of a $\frac{7}{2}^+$ ground state and an isomeric state as $\frac{1}{2}^-$. Measurements of the relative thermal neutron activation cross-section of the two levels and the ratio of the K x rays due to internal conversion of the 74.2-Mev transition and the 129-keV γ ray of the daughter activity suggested the following explanation: the transition occurs between the $\frac{1}{2}^-$ level and the $\frac{7}{2}^+$ ground state and consists of 90% E3 plus 10% M4 γ radiation (after conversion, 73% total E3 transitions and 27% total M4 transitions). (L.M.T.)

999

Brookhaven National Lab.

SHORT-LIVED CERIU M ISOTOPES FROM URANIUM FISSION, by A. A. Caretto, Jr. and S. Katcoff. [nd] 4p. (BNL-1300)

A chemical procedure effecting high purification of the sample was employed in the study of short-lived Ce isotopes produced by U fission to investigate the existence of 1.8-hr Ce^{145} and 4.5-hr Pr^{145} . Seven irradiations of uranyl nitrate followed by Ce separation showed the 14.6-min Ce^{146} - 24.6-min Pr^{146} chain and 33-hr Ce^{143} , but in no case was 1.8-hr Ce^{145} or any other Ce half time between 24.6 min and 33 hr found. In the course of the investigation the half life of Pr^{143} was verified as 13.8 day. (L.M.T.)

1000

Ames Lab.

RADIATIONS OF CERTAIN SYNCHROTRON-INDUCED RADIOACTIVITIES, by Streatfield H. Cox, Jr. and L. Jackson Laslett. June 1952. 28p. (ISC-276)

The usefulness of scintillation-counter techniques in studies of synchrotron-induced activities has been confirmed by this investigation. A method developed for preserving and mounting NaI made the use of these crystals practical for γ -ray coincidence and energy measurements. As a specific application of scintillation-counter techniques, the radiations of Ag^{112} and Ag^{113} were studied. Ag^{112} was found to decay

directly to the ground state of Cd^{112} in $63 \pm 10\%$ of the transitions with a β -ray spectrum whose end point was 3.93 ± 0.10 Mev. For the other $37 \pm 10\%$ of the transitions, a γ -ray of 0.62 ± 0.01 Mev and β rays with a maximum energy of 3.26 ± 0.10 Mev were found to be in coincidence. The ft values for Ag^{112} suggest that the two β components may be forbidden, of the type $\Delta I = 2$ with parity change. A β end point of 1.86 ± 0.05 Mev was found for Ag^{113} . (G.Y.)

1001

Naval Research Lab.

THE COLLECTION OF LONG-LIVED NATURAL RADIOACTIVE PRODUCTS FROM THE ATMOSPHERE, by Peter King, Luther B. Lockhart, Jr., Richard A. Baus, Robert L. Patterson, Jr., Herbert Friedman, and Irving H. Blifford, Jr. Oct. 20, 1952. 11p. (NRL-4069)

Long-lived radium decay products (RaD , RaE , Po) were collected from the atmosphere by the use of air filters and rain water. A workable procedure was developed to separate traces of these active materials from rain water through use of aluminum hydroxide floc as a preliminary concentrating agent. Rain effectively removes significant quantities of RaD , RaE , and Po from the atmosphere. The first part of the rain removes a relatively larger portion than later parts of the rain, but all fractions of the rain contain some activity (RaE). The RaD - RaE activity as collected by rain has been found to vary widely at different geographical locations and at different times at any given locality. There is no simple correlation of the activity collected with the character of the rain, the seasons, or the quantity of dirt present in the collection. The average RaD - RaE activity in disintegrations per minute per gallon varied from about 2 at Samoa to 20 at Glenview and NRL. (auth)

1002

BETA-SPECTRA OF Co^{56} , Co^{57} , AND Co^{58} . L. S. Cheng, J. L. Dick, and J. D. Kurbatov. *Phys. Rev.* 88, 887-9(1952) Nov. 15.

For Co^{58} the 472-keV positron spectrum has been confirmed and the K-conversion coefficient of the 805-keV gamma ray has been found to be $2.9 \pm 0.2 \times 10^{-4}$. For Co^{57} the positron spectrum has been found to have an end-point energy of 320 ± 15 keV. Conversion electrons of 119- and 133-keV gamma rays and a very soft (<18-keV) gamma ray emitted by Fe^{57} have been observed. The K/L ratios of the 119- and 133-keV gamma rays have been estimated to be about 6.3 and 5.2, respectively. For Co^{56} two positron spectra have been observed, one having an end-point energy of 1.53 ± 0.02 Mev, the other having an end-point energy of 995 ± 25 keV. (auth)

1003

SHORT-LIVED RADIOACTIVITY; CORRECTION FOR LONG COUNTING PERIODS. Robert H. Schuler. *Nucleonics* 10, No. 11, 96-7(1952) Nov.

In counting short-lived isotopes over a period of time comparable to the half life of the isotope, a correction must be applied to the average rate when one refers to the instantaneous rate at any particular time during the course of the measurement. The integrated count C is given in terms of the correction factor F_m by the relation $C = C_t \Delta t F_m$, where C_t is the instantaneous counting rate. The factor F_m is given by the power series $F_m = \sum_{i=0}^{\infty} (\ln 2)^{2i} n^{2i} / (2i + 1)! = 1.00000 + 0.02002n^2 + 0.00012n^4 + \dots$, where n is the number of half lives over which the count has been taken. (L.T.W.)

1004

ANALYSIS OF α EMISSION IN THE REGION OF THE RARE EARTHS. I AND II. Charles Martin. *Compt. rend.* 235, 878-80, 950-2(1952). (In French)

Energies and half lives of α emission for Nd, Sm, Eu, Gd, and Tb isotopes are predicted in connection with the existence of rare-earth α activity. The reason for the absence of Sm^{146}

and Gd^{150} from nature and the possible existence of Gd^{166} are discussed. (G.Y.)

1005

NOMOGRAM OF LIFETIME-ENERGY-SPIN FOR GAMMA-RAY TRANSITIONS. R. Montalbetti. Can. J. Phys. **30**, 660-2(1952) Nov.

A nomogram of the recent Weisskopf formula relating the mean life for gamma-ray transitions to the energy and spin change has been constructed. The nomogram is useful in that it allows rapid computations and shows at a glance the dependence of mean lifetime upon the variables involved. (auth)

1006

NOTE ON THE FORBIDDEN TRANSITIONS IN BETA-DECAY. Y. Tomozawa and M. Umezawa. Progress Theoret. Phys. (Japan) **7**, 323-5(1952) Mar.

Some observations on matrix expression of forbidden transitions in β decay formulated by various authors are presented. The highly forbidden transitions in several nuclei and the first forbidden transition in Tm^{170} are tabulated. Log ft values of nuclei which decay directly to the ground state of the final nuclei are given. (L.T.W.)

1007

BETA-SPECTRUM OF THE THIRD FORBIDDEN TRANSITION OF Rb^{87} . Y. Tomozawa, M. Umezawa, and S. Nakamura. Progress Theoret. Phys. (Japan) **7**, 317-21(1952) Mar.

The Rb^{87} beta spectrum of the third forbidden transition is well explained by the combination of two matrix elements $Q_3(\beta[\sigma \times r], r)$ and $Q_3(\beta\alpha, r)$. Complex gamma functions are calculated according to Martin. Screening correction is taken into account. (auth)

1008

RELATION BETWEEN THE RADIOACTIVE PROPERTIES OF NUCLEI AND THE CHEMICAL STRUCTURE OF THE SUPPORTING MOLECULE. R. Daudel. J. phys. radium **13**, 557-62(1952) Nov. (In French)

Theoretically, it should be possible to detect a variation in the half life of a radioactive nucleus with differences in structure of the enclosing molecule for the cases of electron capture, internal conversion, and β emission. The theory of the three cases and observation of the first two are reviewed. Observation of such external effects on β emission would permit study of the phenomenon of electron creation, i.e., retention of the emitted particle by an electron orbit of the same atom. (tr-auth)

1009

THE DISINTEGRATION OF I^{131} . J. R. Haskins and J. D. Kurbatov. Phys. Rev. **88**, 884-6(1952) Nov. 15.

The results of the authors for internal conversion coefficients, K to L ratios, and multipole assignments for the 284-, 364-, 638-, and 723-kev gamma rays are reported. A review of recent decay schemes and a tabulation of internal conversion coefficients, K to L ratios, and relative intensities obtained by previous investigators are included. A level scheme is proposed which involves the forbiddenness of certain magnetic-dipole transitions. (auth)

1010

RADIOISOTOPES OF OSMIUM. J. B. Swan and R. D. Hill. Phys. Rev. **88**, 831-5(1952) Nov. 15.

Osmium activities of 15-day and 32-hour half lives have been identified with Os^{191} and Os^{193} , respectively. A 14-hour activity, decaying by a 74.2-kev gamma transition into the 15-day activity, has been assigned to an isomeric state in Os^{191} . The decay scheme of Os^{191} has been investigated and a $\frac{7}{2}^+$ assignment has been made to the 15-day ground state and an $i\frac{13}{2}$ assignment to the 14-hour isomeric state. The $\frac{7}{2}^+$ state is attributed to a coupling of an odd number of $i\frac{13}{2}$ neutrons. (auth)

1011

RADIOACTIVITY OF SCANDIUM 43. J. R. Haskins, J. E. Duval, L. S. Cheng, and J. D. Kurbatov. Phys. Rev. **88**, 876-7(1952) Nov. 15.

The positron and photoelectron spectra of radioactive Sc^{43} have been investigated. A gamma ray of 0.375 ± 0.002 Mev and positron groups of 1.18 ± 0.02 Mev and 0.77 ± 0.04 Mev are assigned to the decay of Sc^{43} . (auth)

1012

REINVESTIGATION OF THE RADIOACTIVITY OF Sb^{124} . D. R. Hutchinson and M. L. Wiedenbeck. Phys. Rev. **88**, 699-700(1952) Nov. 15.

The beta spectrum of Sb^{124} was studied with a thin-lens spectrometer with particular emphasis on the internal conversion of the 0.607 and 1.7-Mev gamma rays and the shape of the high energy beta spectrum. The conversion coefficients of the 0.607-Mev gamma ray were found to be $\alpha_K = 3.63 \pm 0.40 \times 10^{-3}$, $\alpha_L = 5.15 \pm 1.0 \times 10^{-4}$. Comparison of α_K with theoretical values indicated the transition to be electric quadrupole. An upper limit of 5×10^{-4} has been set on the conversion coefficient of the 1.7-Mev gamma ray. The highest energy beta component was shown to be first-forbidden. The next highest beta component may possibly be first-forbidden also. (auth)

1013

INVESTIGATION OF THE γ TRANSITIONS OF 188 KEV IN Ra AND 87 KEV IN $RdTh$. C. Victor, J. Teillac, P. Falk-Vairant, and G. Bouissières. J. phys. radium **13**, 565-6(1952) Nov. (In French)

From a study of α particle-conversion electron coincidences, the number of electrons per disintegration was found to be 0.030 ± 0.003 for Ra^{226} and 0.25 ± 0.01 for $RdTh$ (Th^{228}). For Ra^{226} , a value of 0.88 was deduced for the total conversion coefficient, and a rough estimation of $\frac{1}{2}$ was made for the K/L ratio. The γ radiations for both nuclides were confirmed to be electric quadrupole. (G.Y.)

1014

A 30-SEC ISOMER Au^{195m} . O. Huber, R. Joly, P. Scherrer, and N. F. Verster. Helv. Phys. Acta **25**, 621-4(1952) Nov. 1. (In German)

The conversion-electron spectrum of Hg^{195} , produced by the $Au^{197}(d,n)$ reaction, is shown. Two γ lines of 56 and 259 kev are attributed to 30-sec Au^{195m} . The 9.5 ± 0.5 -hr activity of Hg^{195} is assigned to the ground state; the known 38-hr half life is attributed to an excited state. (G.Y.)

1015

RADIATIVE CORRECTION TO DECAY PROCESSES, III. FORBIDDEN BETA-TRANSITIONS CAUSED BY RADIATION PROCESSES. Sigeo Hanawa and Tatuoki Miyazima. Progress Theoret. Phys. (Japan) **7**, 391-8(1952) Apr.

Forbidden beta transitions caused by the radiative correction are investigated on the basis of an effective hamiltonian which was derived elsewhere by use of the covariant formalism. The ultraviolet divergence inherent in the virtual photon processes has been removed with the aid of the regulator method. The results are compared with those described by other authors with the use of the noncovariant perturbation theory. (auth)

1016

THE ORIGINS OF BACKGROUND TRACKS IN SHIELDED ELECTRON-SENSITIVE EMULSIONS. M. C. Walters. Proc. Phys. Soc. (London) **A65**, 959-60(1952) Nov. 1.

At 600 meters below ground, 200- μ Ilford G5 emulsion screened behind 2-in. Pb walls accumulated electron tracks at the rate of 2.6 ± 0.1 mm⁻²/day, which is considerably larger than that to be expected from cosmic radiation (of the order of 10^{-2} mm⁻²/day). An analysis of the factors contributing gave the following results:

Origin of tracks

Observed rate of formation
(mm⁻² per day)

Thorium present in glass backing	0.57 ± 0.05
K ⁴⁰ present in glass backing	1.00 ± 0.05
C ¹⁴ present in gelatine	0.83 ± 0.06
Shielding (entering plate at upper surface)	0.14 ± 0.02

The background has been considerably reduced by coating the emulsion on a 1/16-in. perspex sheet. (L.M.T.)

1017

RADIOACTIVE GOLD ISOTOPES. F. D. S. Butement and R. Shillito. *Proc. Phys. Soc. (London)* **A65**, 945-9(1952) Nov. 1.

The half lives, mass assignments, and radiation characteristics of three neutron-excess gold isotopes have been determined as follows:

	Au ²⁰⁰	Au ²⁰¹	Au ²⁰³
Half-life	48 min	26 min	55 sec
Max. β energy (Mev)	2.2	1.5	1.9
γ -energy (Mev)	0.39, 1.13	0.55	0.69

The isotopes were produced by the appropriate irradiations of mercury metal or thallium nitrate. (auth)

1018

A SEARCH FOR THE NATURAL RADIOACTIVITY OF VANADIUM. S. G. Cohen and R. Bauminger. *Bull. Research Council Israel* **2**, 195(1952) Sept.

The decay of V⁵⁰ to Ti⁵⁰ by K capture and the possible β decay of V⁵⁰ to Cr⁵⁰ have been reexamined with more sensitive apparatus. No more than 2 cpm were attributable to the V sample, and from this the decay half lives were estimated as greater than 10¹² years. (L.M.T.)

1019

THE BETA-SPECTRA OF Pu²³⁹, Pu²⁴⁰, AND Pu²⁴¹. Melvin S. Freedman, F. Wagner, Jr., and D. W. Engelkemeir. *Phys. Rev.* **88**, 1155-8(1952) Dec. 1.

The beta spectrum of Pu²⁴¹ measured in a double-lens spectrometer on samples containing Pu²³⁹, Pu²⁴⁰, and Pu²⁴¹, exhibits an allowed shape from E₀ = 20.5 kev to 14 kev, where instrumental effects distort it. Conversion lines found beyond the end point combined with gamma-scintillation counter measurements lead to the assignment of gammas of 39, 53, 100, 124, and 384 kev associated with the alpha decay of Pu²³⁹, and a gamma of 49.6 kev accompanying the alpha decay of Pu²⁴⁰; and the existence of 26.4 and 59-kev gammas in Am²⁴¹ alpha decay is confirmed. A conversion line corresponding to a highly converted 41-kev gamma in Am²⁴¹ was found. Gammas of 100 and 145 kev probably associated with the alpha branch in Pu²⁴¹ were also found. The influence of the orbital-electronic-rearrangement energy on the beta decay is discussed. (auth)

1020

RADIATIONS OF Ce¹⁴³. W. H. Burgus. *Phys. Rev.* **88**, 1129-32(1952) Dec. 1.

A spectrometric investigation of the radiations of Ce¹⁴³ has revealed that there are beta-ray groups of 1.090 ± 0.005, 1.390 ± 0.005, and 0.710 ± 0.010 Mev maximum energy. In addition, there was evidence for a fourth lower-energy group which could not be resolved. Electromagnetic radiations of energies 0.0349 ± 0.001, 0.126 ± 0.005, ~0.160 ± 0.010, 0.289 ± 0.005, 0.356 ± 0.005, 0.660 ± 0.010, and 0.720 ± 0.010 Mev were found. A decay scheme for Ce¹⁴³ is proposed. (auth)

1021

SOME NEUTRON DEFICIENT STRONTIUM ISOTOPES. Stanley V. Castner and D. H. Templeton. *Phys. Rev.* **88**, 1126-8(1952) Dec. 1. (cf. NSA 5-888)

Bombardment of rubidium with protons produced Sr⁸¹, half life 29 minutes, Sr⁸², half life 25 days, and Sr⁸³, half life 38 hours, Sr⁸¹ and Sr⁸³ are assigned on the basis of their positron decay to known Rb⁸¹ and Rb⁸³, respectively. The half life of Rb⁸³ has been redetermined as 83 days, and it has been shown that it decays in part to the 1.8-hour Kr^{83m}. Sr⁸² probably decays by electron capture to a short-lived isomer of Rb⁸², which in turn decays by emission of 3.15-Mev positrons. In this case, the mass assignment is based on the energy required to produce the activity in a bombardment, because the known Rb⁸² was not observed as a decay product. (auth)

1022

GAMMA RADIATION OF Fe⁵⁹. B. S. Dzhelepov, N. N. Zhukovskii, and Yu. V. Khol'nov. *Doklady Akad. Nauk S.S.S.R.* **86**, 497-9(1952) Sept. 21. (In Russian)

Experimental curves of the γ radiations of Fe⁵⁹, as determined with a γ -ray spectrometer, are shown. The γ spectra consists of two lines of 1.100 ± 0.011 and 1.278 ± 0.013 Mev energy and 1.39 ± 0.05 : 1 relative intensity. (G.Y.)

1023

THE BETA-GAMMA ANGULAR CORRELATION OF ¹⁷⁰THULIUM. H. Rose. *Phil. Mag.* (7) **43**, 1146-50(1952) Nov.

A thin-magnetic-lens beta-ray spectrometer has been modified to enable the beta-gamma angular correlation of Tm¹⁷⁰ to be measured as a function of beta-ray energy. Assuming that a single matrix element is operative in the low-energy beta-ray transition of Tm¹⁷⁰, the results give a good agreement with the theoretical predictions for the matrix element $\beta\sigma \times r$ occurring in the first forbidden tensor interaction but appear to rule out the corresponding $\beta\sigma \times r$ of the first forbidden axial vector interaction. It is, however, possible that a suitable mixture of matrix elements might also fit the experimental data. (auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

1024

THE "EXTRA" LEVELS IN RARE EARTH SALTS. H. E. D. Scovil and K. W. H. Stevens. *Proc. Phys. Soc.* **A65**, 954-5(1952) Nov. 1.

A number of rare-earth crystals, both concentrated and diluted with lanthanum ethyl sulfate, show two resonance lines with very similar g values, which do not cross when the crystal is rotated in a magnetic field. This suggests that the "extra" levels in rare-earth absorption spectra may be created by electrostatic fields in the crystals and may be a superposition of the individual, slightly different, spectral levels. (L.M.T.)

SHIELDING

1025

DESIGN AND CONSTRUCTION OF SHIELDING WINDOWS. K. R. Ferguson. *Nucleonics* **10**, No. 11, 46-51(1952) Nov.

Capabilities and limitations of shielding windows and properties of various transparent shielding materials are discussed. Three possible window constructions are described. These include the ZnBr window, glass window, and the composite window. (L.T.W.)

THEORETICAL PHYSICS

1026

THE THEORY OF HYDROGEN THREE. Robert L. Pease and Herman Feshbach. *Phys. Rev.* **88**, 945-50(1952) Nov. 15.

The binding energy of the triton has been calculated by the variational method. The forces between the particles are assumed to be charge independent and to be composed of central and tensor parts, the radial dependence of each being given by Yukawa wells. The binding-energy calculation is employed to determine the range of the tensor component; the

other constants are fixed by the low-energy two-body data. The effective triplet range, the percentage D state in the triton, and the coulomb energy of He^3 are then predicted. The first two of these are in satisfactory agreement with experiment; the third is in error by twenty-five percent. The final "best" potential contains only four constants, the ranges and depths of the central and tensor potentials. The triplet and singlet central forces are equal. (auth)

1027

THE GENERAL DISCUSSION OF THE SELF-STRESS. Y. Takahashi and H. Umezawa. Progress Theoret. Phys. (Japan) 7, 330(1952) Mar.

It is proved that the vanishing self-stress of an arbitrary elementary particle is also obtained by the point model in any order of perturbation, as far as the present field theory is concerned. (L.T.W.)

1028

ON L. DE BROGLIE'S THEORY OF THE PHOTON. M. El-Nadi. J. phys. radium 13, 540-2(1952) Nov. (In French)

A new notation specially adapted to the theory of spin-1 particles developed by de Broglie is proposed. It makes clearer the correspondence between the real macroscopic fields and the imaginary microscopic fields associated with the photon. (tr-auth)

1029

ON THE RENORMALIZATION IN QUANTUM ELECTRODYNAMICS. Susumu Kamefuchi and Hiroomi Umezawa. Progress Theoret. Phys. (Japan) 7, 399-405(1952) Apr.

A new renormalization procedure in quantum electrodynamics is presented in this paper. With this procedure, the finite S-matrix can be automatically obtained by use of the modified commutation relations and propagation functions and, therefore, without introducing the counter terms of mass and charge types. The various significant features of this new renormalization procedure are also discussed. (auth)

1030

ON A MODIFIED DEFINITION OF RIESZ POTENTIAL FOR THE MESON CASE. L. S. Kothari. Proc. Phys. Soc. (London) A65, 930-3(1952) Nov. 1.

A modified definition of the Riesz potential for the meson field is introduced. It is shown that the new definition is a generalization, in the α plane, of the meson potential in the interaction representation. The relations satisfied by the meson potential in the interaction and in the Schroedinger representations are compared. (auth)

1031

ELEMENTARY PARTICLES AT REST. Enrique Bustamante. Phys. Rev. 88, 1179-81(1952) Dec. 1.

The object of this paper is to present a theory of the structure of elementary particles at rest. Some applications are included; in particular a solution to an unsolved problem in astronomy is presented. (auth)

TRITIUM AND TRITIUM COMPOUNDS

1032

THE BETA-SPECTRUM OF TRITIUM AND THE MASS OF THE NEUTRINO. L. M. Langer and R. J. D. Moffat. Phys. Rev. 88, 689-94(1952) Nov. 15.

A direct determination of the beta spectrum of H^3 has been made in a high-resolution magnetic spectrometer. The experimental data are fitted by a straight-line Fermi plot from 5.5 kev to the maximum energy at 17.95 ± 0.10 kev. An upper limit of 250 volts or 0.05 percent of the mass of the electron is obtained for the rest mass of the neutrino. New estimates are obtained for the H^3 comparative half life, the neutron half life, and the value of the Fermi universal constant of beta decay. (auth)